Mathematics 6

Data Analysis

Mathematics 6

Module 8

Data Analysis

This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	
General Public	
Other	

You may find the following Internet sites useful:

- Alberta Learning, **http://www.learning.gov.ab.ca**
- Learning Technologies Branch, **http://www.learning.gov.ab.ca/ltb**
- Learning Resources Centre, **http://www.lrc.learning.gov.ab.ca**

The use of the Internet is optional. Exploring the electronic information superhighway can be educational and entertaining. However, be aware that these computer networks are not censored. Students may unintentionally or purposely find articles on the Internet that may be offensive or inappropriate. As well, the sources of information are not always cited and the content may not be accurate. Therefore, students may wish to confirm facts with a second source.

Welcome to
Mathematics 6

Mathematics 6 contains nine modules.
You should work through the modules in order (from 1 to 9)
because concepts and skills introduced in one module will be
reinforced, extended, and applied in later modules.

Module 1
**Estimating and
Representing Number**

Module 2
Number Operations

Module 3
Patterns

Module 4
**Fractions, Ratio,
and Percent**

Module 5
Measurement

Module 6
**Angles, Shapes,
and Objects**

Module 7
Transformations

Module 8
Data Analysis

Module 9
Probability

SPACE SHUTTLE
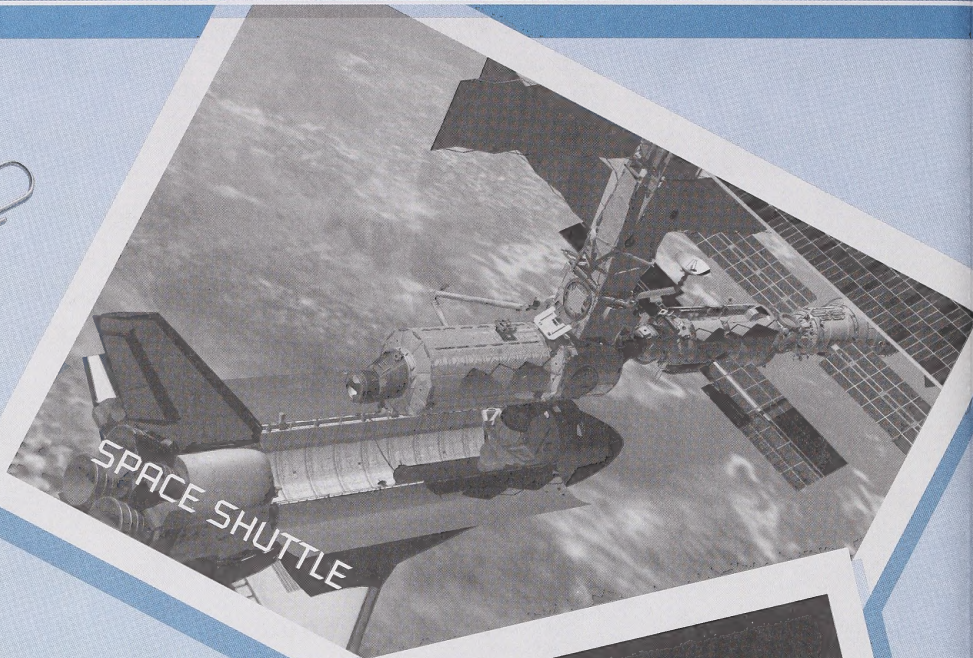
INTERNATIONAL SPACE STATION

Adventures in Outer Space

Matthew: Wow, what a wonderful experience it was meeting Colonel Chris Hadfield at the Odyssium! He gave a presentation here in Edmonton on July 9, 2001, and talked about his adventures in space, including his mission aboard the Space Shuttle *Endeavor* to attach Canadarm2 to the International Space Station.

It's too bad you missed it, Kylee. You were away visiting your grandmother in Slave Lake.

Kylee: My trip was great, but I sure wish I could have heard Colonel Hadfield talk about being the first Canadian to walk in space. But, I've got great news for you, Matthew! Commander Claire from the International Space Station is coming to town, and you and I will be spending some time with her.

I can't wait to hear about her adventures in space!

CANADARM2

NATIONAL SPACE STATION

Table of Contents

Commander Claire

Course Features

Take the time to look through the Student Module Booklets and the Assignment Booklets and notice the following design features:

- Each module has a Module Overview, Module Summary, and Review.

- Each module has several lessons. Each lesson focuses on a big idea that is central to the topic being learned in the module.

- Each lesson has several activities. An activity in each lesson is related to the Adventures in Outer Space theme.

- Each module has a Glossary and an Answer Key in the Appendix. In several modules there are also special pull-out pages in the Appendix.

- Each module has special exercises that focus on certain mathematical skills. The Numbers in the News project involves a scavenger hunt for samples of math in everyday life. The Keystrokes exercise introduces some "funky features" of the calculator that can be used to explore and practise important number ideas. Just the Facts gives you the opportunity to practise your basic number facts by doing a timed drill with your home instructor. The Mental Math exercise introduces an estimation skill or mental-computation strategy that you can use to sharpen your mental math skills.

- Each module references the Mathematics 6 Companion CD that includes additional material for review and mastery.

Required Resources

There are no spaces provided in the Student Module Booklets for your answers. This means you will need a binder and loose-leaf paper or a notebook to do your work.

In order to complete the course, you will need a copy of the Mathematics 6 textbook, *Quest 2000: Exploring Mathematics*, *Grade 6*, the soft-cover book *Quest 2000: Exploring Mathematics: Practice and Homework Book*, *Grade 6*, a basic four-operation calculator (such as the TI-108 calculator), and various manipulatives (base ten blocks and pattern blocks).

If you wish to complete the optional computer activities, you must have access to a computer that is connected to the Internet.

You will also need access to a computer to view material on the Mathematics 6 Companion CD.

Visual Cues

For your convenience, the most important mathematical rules and definitions are highlighted. Icons are also used as visual cues. Each icon tells you to do something.
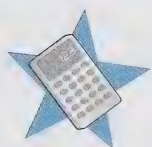
Use your calculator.	Use the Internet.
Refer to the textbook or the Practice and Homework Book.	Use the Mathematics 6 Companion CD.

Assessment and Feedback

The Mathematics 6 course is carefully designed to give you many opportunities to discover how well you are doing. In every activity you will be asked to turn to the Appendix to check your answers. Completing the activities and comparing your answers to the suggested answers in the Appendix will help you better understand math concepts, develop math skills, and improve your ability to communicate mathematically and solve problems.

If you are having difficulty with an activity, refer to the Answer Key in the Appendix for hints or help. As well as giving suggested answers to the questions, the Answer Key gives you more information about the questions.

Twice in each module you will be asked to give your teacher your completed assignments to mark. Your teacher will give you feedback on how you are doing.

After your teacher marks an assignment, be sure to review your teacher's comments and correct any errors you made.

There will be a final test at the end of the course. You can prepare for the final test by completing the Review at the end of each module.

Module Overview

LIBRARY OF PARLIAMENT/BIBLIOTHÈQUE DU PARLEMENT

When you see a picture of the Parliament Buildings in Ottawa, do you think only about the federal government, or are you reminded of the entire country and the more than 31 million Canadians who live within its borders? Statistics Canada is responsible for collecting information to help Canadians understand their country better. Statistics Canada collects information on almost every aspect of life in Canada by conducting a census every five years and by surveying representative groups of Canadians in over 350 ongoing studies every year!

In this module you will explore how you can collect data from surveys, how you can organize and present data graphically, and how you can make decisions based on your data.

Lesson 2
Displaying
Data

Lesson 1
Surveys and
Samples

Lesson 3
Comparing and
Analysing Data

Your mark on this module will be determined by how well you complete the two Assignment Booklets.

The mark distribution is as follows:

Assignment Booklet 8A
    Lesson 1 Assignment   30 marks
    Lesson 2 Assignment   30 marks

Assignment Booklet 8B
    Lesson 3 Assignment   30 marks
    Numbers in the News   10 marks

    Total   100 marks

When doing the assignments, work slowly and carefully. Be sure you attempt each part of the assignments. If you are having difficulty, you may use your course materials to help you, but you must do the assignments by yourself.

You will submit Assignment Booklet 8A to your teacher before you begin Lesson 3. You will submit Assignment Booklet 8B to your teacher at the end of this module.

Numbers in the News

Read through the following list before you begin Module 8. Begin by collecting samples of the ideas you already understand; others you may collect as you learn about them in the module. The samples you collect will depend on the newspapers or magazines you use.

Scavenger Hunt

Cut out articles or advertisements from newspapers or magazines that show data being used in different situations. Here are some suggestions of things to look for:

- articles about surveys and samples

- various types of data displays, including
  - pictographs
  - bar graphs
  - double-bar graphs
  - stem-and-leaf plots
  - histograms
  - line graphs
  - circle graphs

- tables that compare data

- reports about studies or experiments that use statistical methods

You will find further instructions for completing and submitting your project in Assignment Booklet 8B.

Surveys and Samples

HILAL HAYMOUR, CALGARY SCIENCE CENTRE

The two Grade 6 classes from Amisk School are planning an overnight field trip to the Calgary Science Centre. Manuel and Shiraz have volunteered to serve on the committee responsible for planning the late-night lunch. Before they make any decisions, Manuel and Shiraz plan to survey the two classes to see what their classmates would like to eat. How do you think Manuel and Shiraz should conduct this survey?

In this lesson you will explore how survey questions are designed and how these questions can be used to collect data.

Activity 1

Today you will begin your investigation of **surveys**.

Since the Space Shuttle Program began in 1981, astronauts have chosen all their food from a menu before a mission begins. One morning, as she was eating breakfast on the International Space Station, Commander Claire wondered which of the available cereals was most popular with Space Shuttle astronauts.

A **population** is an entire group of people or things for which information is needed. For example, suppose a politician running for mayor in your community would like to know her level of support prior to the election. The population for which this information is needed consists of all those eligible to vote in the election.

1. Describe the population about which Commander Claire wants information.

A **sample** is a small part of a population from which information is collected. Often it is not possible or practical to collect information from the entire population. It is important that the information selected from the sample be as close as possible to what information would have been obtained if the entire population were surveyed.

Generally speaking, information taken from a greater number of people or objects in a population will be more valid than results taken from a smaller sample of the population.

Once again, consider the example of the politician running for mayor. Suppose her staff phoned 200 voters at random and asked them if the politician could count on their support. The 200 voters form the sample. If the sample is representative of all voters, then the level of support would be nearly the same in the sample as in the population.

2. Claire decided to begin her investigation by surveying her fellow crew members on the space station. Why do you think she decided to do this?

First-hand data is data you collect directly through your own questioning or observation at the source.

3. Write a survey question that Commander Claire might ask the crew members, and explain how she might go about recording their answers.

Second-hand data is collected by others and found in other sources, such as books or databases.

4. Claire continued her investigation when she got back to Earth. Since several hundred astronauts have participated in the Space Shuttle missions to date, she wanted to get a much larger sample of data than information from just her crew.

The space centre keeps detailed records of everything brought aboard the different shuttle missions. Explain how Claire can use the meal lists as a source of second-hand information and select a sample of data.

5. Using the meal lists from all previous 50 Space Shuttle missions, Claire tallied the most popular cereal chosen for each mission. Her results are shown in the following table.

Cereal	Tally of Favourite Cereal	Number of Votes
Bran Wafers	||||| ||	
Korn Flakes	||||| ||||| |||||	
Granola	||||| |||	
Grits	|||	
Oatmeal	|||||	
Crispy Rice	||||| ||||| ||	

a. Copy and complete the table in your notebook.

b. Rank the types of cereal from most favourite to least favourite.

c. From the table, can you tell how many boxes of Crispy Rice were eaten during the previous 50 Space Shuttle missions? Explain.
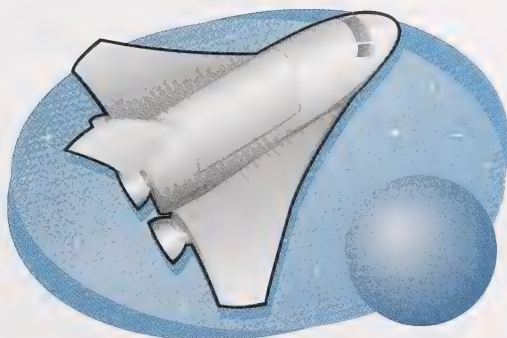
6. A sample is representative of a population if the main features of the population are present in the sample.

    a. Do you think that the size of this sample is appropriate? Explain.

    b. Is the sample used in question 5 likely representative of the population described in question 1? Explain.

    c. Is the sample used in questions 2 and 3 (the astronauts aboard the space station with Claire) likely representative of the population you described in question 1? Explain.

Check your answers on pages 69 and 70 in the Appendix.

7. Claire also decided to conduct a first-hand survey of Space Shuttle astronauts. How might she select a sample of astronauts that is different from the one used in question 5 and distribute the survey question to them?

8. What factors might affect the results of Claire's first-hand survey in question 7 that wouldn't affect the results of her second-hand survey in question 5?

9. How might the space centre use the results of Claire's investigation ?

Check your answers on page 70 in the Appendix.

Activity 2

Today you will explore how samples can be used to make predictions about populations.

The next time you see a commercial on TV, hear a commercial on the radio, or read an ad in a newspaper or magazine, pay close attention. Companies want you to believe that their products or services are the best.

Turn to page 152 in your textbook to Understanding Sampling. Use the ads shown to answer questions 1 to 6.

1. Look at the ad for Tasty Tooth Paste.

   a. For what population does the ad suggest the claim applies?

   b. How many dentists does the ad suggest took part in the survey? Is this likely? Explain.

2. Look at the ad for Checkers Pizza.

   a. For what population does the ad suggest the claim applies?
   b. Is the sample surveyed representative of that population? Explain.

3. Look at the ad for bicycles on page 152 in the textbook.

  a. For what population does the ad suggest the claim applies?

  b. What do you think is meant by the phrase "most popular"?

  c. To decide how many kids between the ages of 10 and 12 should be sampled, it may be helpful to know how many Canadian children there are in that age range. Where might you find this information?

4. Look at the ad for Oceans of Lotion.

  a. What do you think is meant by *majority*?

  b. What questions might doctors have been asked to get data?

  c. If the lotion company chose to mail their survey question to a large number of doctors across Canada, how might the company influence doctors' responses?

5. Look at the ad for Crunchies.

  a. For what population does the ad suggest the claim applies?

  b. What things about the survey might people want to know before they believe what is written about Crunchies? Explain.

6. Look at the ad for Loco-Cocoa.

  a. For what population does the ad suggest the claim applies?

  b. How is this ad similar to the ad for Tasty Tooth Paste? How is it different?

Check your answers on pages 71 and 72 in the Appendix.

The ads you looked at in your textbook gave predictions of what a population is like based on data collected from a sample of that population. Questions 7 and 8 ask you to make the predictions. Before you answer these questions, study the following example.

Example

At John A. Macdonald Middle School, the student council is planning a ski trip that will be open to all students. The student council asked 30 students chosen at random if they plan to go on the ski trip. Seven of the students said they would definitely sign up for the trip. If this sample is representative of the 300 students in the school, how many students in all are likely to sign up for the trip?

There are 10 times as many students in the school as were surveyed in the sample.

$$10 \times 30 = 300$$

Sample size   Total population

Therefore, there are likely to be $10 \times 7 = 70$ students on the ski trip.
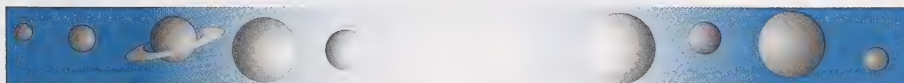
7. Cherinna surveyed the first 50 spectators to arrive at a hockey tournament. She found that 28 of them said their favourite colour of gumdrop was red.

a. If there were about 400 spectators in all, about how many of them might Cherinna predict prefer red gumdrops? Explain.

b. Do you think Cherinna's sampling method allows for a reasonable prediction to be made? Explain.

8. Garth is a cashier at the local fast-food restaurant. He kept count and discovered that he had served 7 customers in the first 10 minutes of his 4-hour shift. Based on this, Garth quickly predicted he would serve at least 160 customers that day.

a. How do you think he arrived at that prediction?
b. Do you think his prediction is reasonable? Explain.

9. In order to select a representative sample, what things are most important for you to keep in mind?

Check your answers on pages 72 and 73 in the Appendix.

Activity 3

Today you will collect and analyse data from observations and experiments.
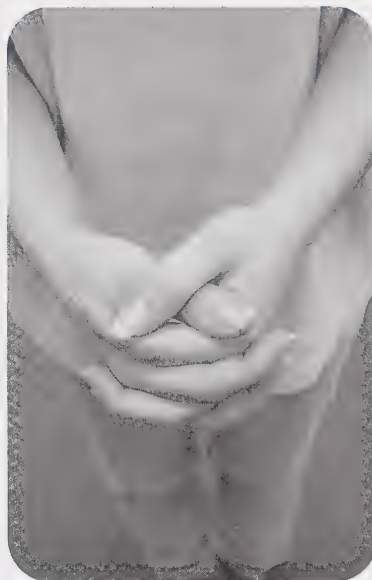
The surveys in Activity 1 and Activity 2 were conducted by asking people questions, either in person or in writing. In this activity you will conduct a survey in which you collect data by conducting an experiment and observing the results.

Everybody has habits in which their behaviour is automatic; that is, they do not think about how they are doing something. For example, clasp your hands together by interlocking your fingers. Look to see if your right thumb or your left thumb is on top.

1. **a.** Could you have predicted which thumb you would put on top without thinking about it?

   b. Now change your grasp so you are clasping your hands with the opposite thumb on top. How does it feel when you purposely put the opposite thumb on top?
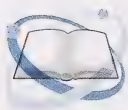
Turn to page 153 in your textbook to On Your Own. Look at the pictures of clasped hands. The following questions will guide you to do the hand-clasp experiment with other people.

2. Write the directions you will give the people that you survey.

3. Try to survey at least 30 people, with about an equal number of males and females.

   a. Tell where you went to get your data.

   b. Tally your results in a table like the following.

	Tallies for Males	Tallies for Females
Left Thumb on Top	卌 II	卌
Right Thumb on Top	卌 卌 III	卌 卌 卌

4. Summarize your results by writing your tally sums in a table like the following.

	Totals for Males	Totals for Females	Total People
Left Thumb on Top			
Right Thumb on Top			
Total People			

5. a. Tell how the total number of people with the right thumb on top compares to the total number of people with the left thumb on top.

   b. Do your results show a difference between males and females? Explain.

6. For which population are your results a sample?

Check your answers on pages 73 and 74 in the Appendix.

Questions 7 to 9 are optional. Do these questions if you need more practice making predictions from samples.

7. The following table shows the results from a sample of people that were at a community park one afternoon. Describe how these results compare with your results.

	Males	Females	Total People
Left Thumb on Top	18	13	31
Right Thumb on Top	17	19	36
Total People	35	32	67

8. Use the results from question 7 to predict the answers to these questions.

   a. About how many people in the population will put the left thumb on top?

   b. About how many people in the population will put the right thumb on top?

9. Can you always accurately predict that something will be true for a population if it is true for a sample of that population? Explain.

Check your answers on page 74 in the Appendix.

Sharing Time

Now it's time to show your home instructor what you have been learning.

Turn to page 64 of the Practice and Homework Book and complete questions 1 to 6.

Discuss your answers with your home instructor.

Challenge Activity

Bretta polled the players on her soccer team by asking them how many sisters and brothers they have. Kris said he has the same number of brothers as he has sisters. His twin sister, Lily, said she has twice as many brothers as she has sisters. If there are fewer than 10 children in their family, how many of them are girls and how many are boys?

Check your answer on page 75 in the Appendix.

Conclusion

In this lesson you explored how to ask survey questions, choose appropriate data sources, select representative samples, and collect data to answer questions.

Now that you know more about surveys, survey questions, and representative samples, reread the introduction to Lesson 1. How would you help Shiraz and Manuel decide what kind of lunch to prepare for their field trip to the Calgary Science Centre?

Turn to Assignment Booklet 8A and complete the Lesson 1 Assignment.

Keep Assignment Booklet 8A until you have completed the entire booklet.
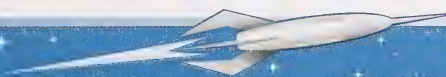
Displaying Data
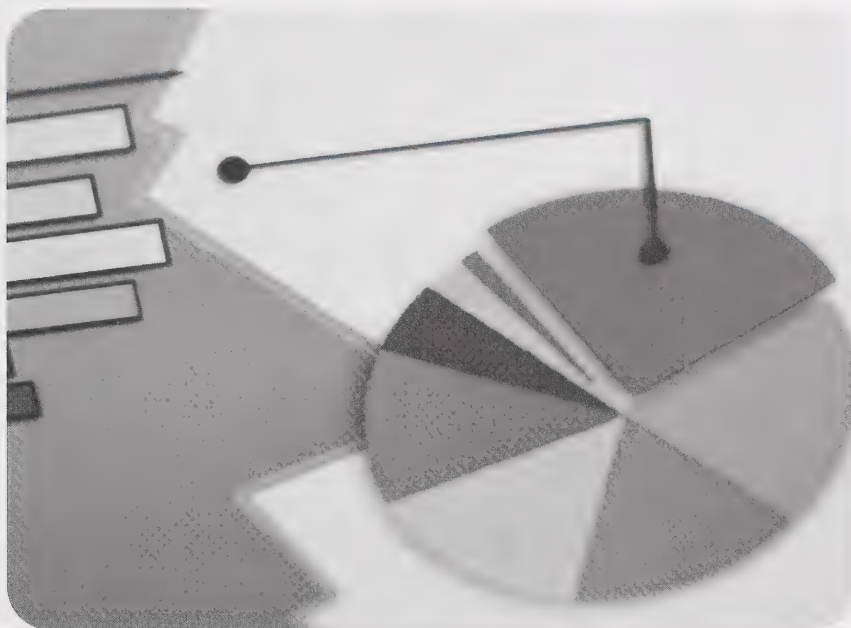
Once you have collected data from a survey, you must decide how to organize and present the data. Statisticians recognize that there is a lot of truth in the old saying "A picture is worth a thousand words." Graphs are a means of representing numbers with pictures. Computer software is used to help statisticians create the most accurate and visually attractive graphs possible!

In this lesson you will extend what you know about choosing and making appropriate data displays. You will be introduced to double-bar graphs, stem-and-leaf plots, and histograms.

Activity 1
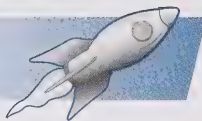
Today you will explore how to present survey data graphically.

The first piloted spaceflights began in 1961,
signalling the race to the moon!

The race between Russia and the United States to be the first to send men to the moon began in earnest on April 12, 1961. The Russian cosmonaut Yuri Gagarin, in the spacecraft *Vostok 1*, became the first human to orbit Earth. A little more than eight years later, the American astronauts Neil Armstrong and Edwin Aldrin Jr. landed their *Apollo 11* lunar module in the Sea of Tranquillity and became the first men to walk on the moon's surface.

If you have access to the Internet, you can learn more about these missions at the following websites:

- **http://starchild.gsfc.nasa.gov/docs/StarChild/shadow/whos_who_level2/gagarin.html**

- **http://nssdc.gsfc.nasa.gov/nmc/tmp/1969-059A.html**

The following table shows the number of human spaceflights made by the United States and Russia up to the first moon landing.

HUMAN SPACEFLIGHTS FROM 1961 TO FIRST MOON LANDING

Year	American Program	Russian Program
1961	2	2
1962	3	2
1963	1	2
1964	0	1
1965	5	1
1966	5	0
1967	1	1
1968	2	1
1969 (up to July)	3	2

The data from the table is displayed in the following two bar graphs.

AMERICAN HUMAN SPACEFLIGHTS FROM 1961 TO JULY 1969
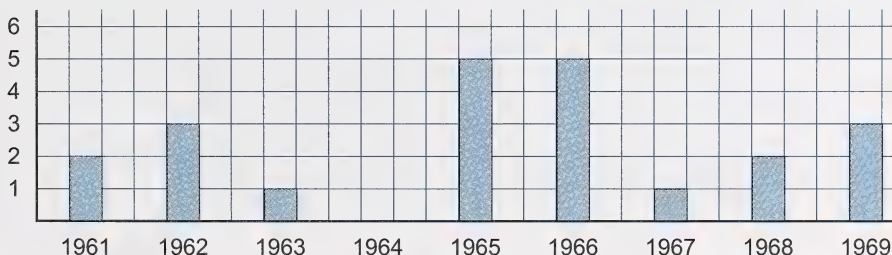
RUSSIAN HUMAN SPACEFLIGHTS FROM 1961 TO JULY 1969
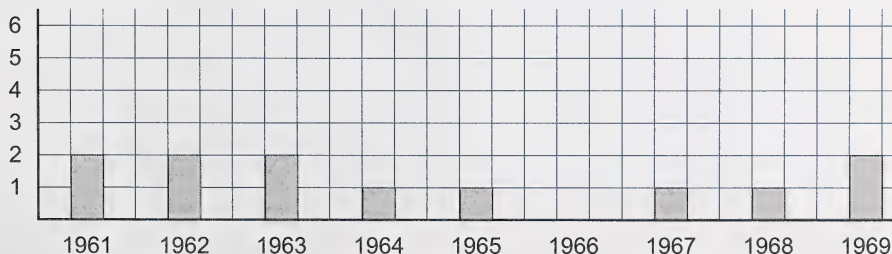
The preceding graphs show the number of American spaceflights and the number of Russian spaceflights for each year. By combining these two graphs, you can easily compare the number of American spaceflights with the number of Russian spaceflights for each year. This is shown in the following **double-bar graph**. Use this graph to answer questions 1 to 6.

AMERICAN AND RUSSIAN HUMAN SPACEFLIGHTS FROM 1961 TO JULY 1969
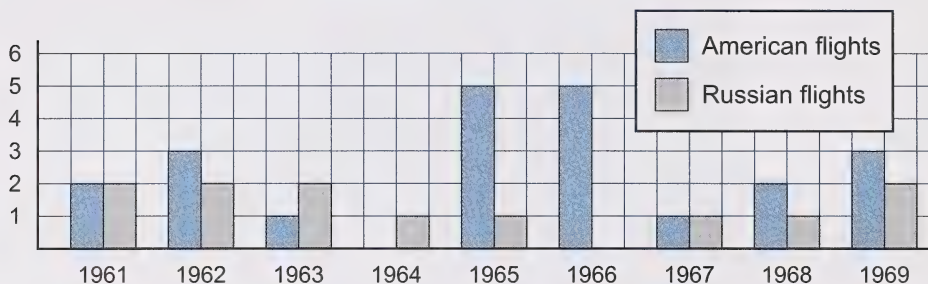
A double-bar graph is a bar graph that displays two sets of data.

1. In the time period from 1961 up to the first moon landing, who made more human spaceflights in total, the Americans or the Russians? How many more?

2. In which years did the Russians and the Americans make the same number of human spaceflights?

3. In which years did the Russians make more human spaceflights than the Americans?
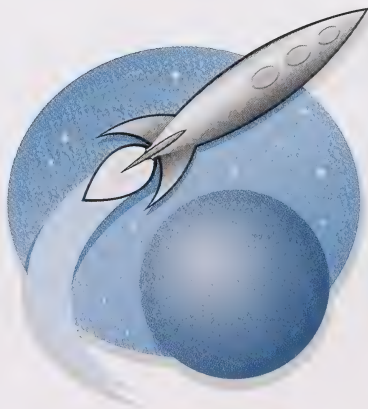
4. By the end of which year had the Russians made more human spaceflights in total than the Americans?

5. In which two-year period did the Americans make almost half of their human spaceflights?

6. How are the spaceflights for 1964 similar to the spaceflights for 1966?

7. Which of questions 1 to 5 were most easily answered using the double-bar graph? Explain.

Questions 8 and 9 are optional. Do these questions if you need more practice comparing two sets of data.

The following table shows the number of male and female crew members on Space Shuttle missions in five-year periods from 1981 to 2000.

MALE AND FEMALE CREW MEMBERS ON SPACE SHUTTLE MISSIONS

Five-Year Period	Males	Females
1981–1985	109	9
1986–1990	72	9
1991–1995	176	36
1996–2000	155	30
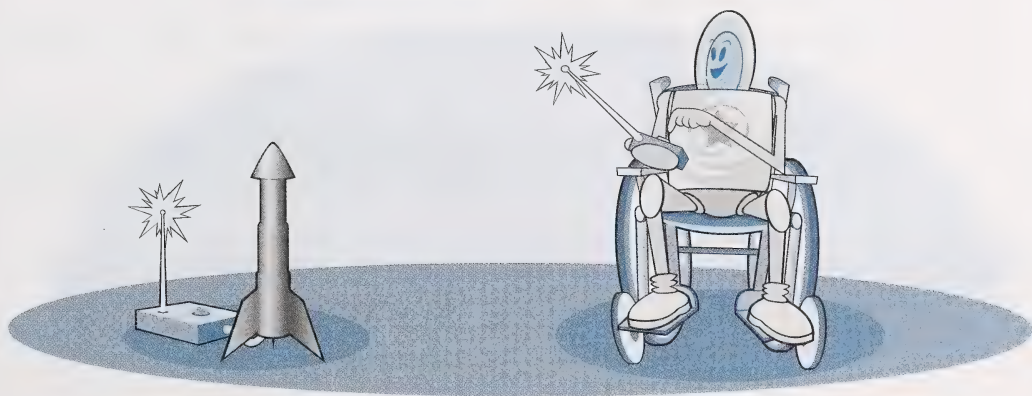
8. Copy and complete the following double-bar graph on a sheet of graph paper from the Appendix to display the data in the table. (Include proper labelling.) Use your graph to answer questions 8 and 9.

NUMBER OF MALE AND FEMALE CREW MEMBERS ON SPACE SHUTTLE MISSIONS
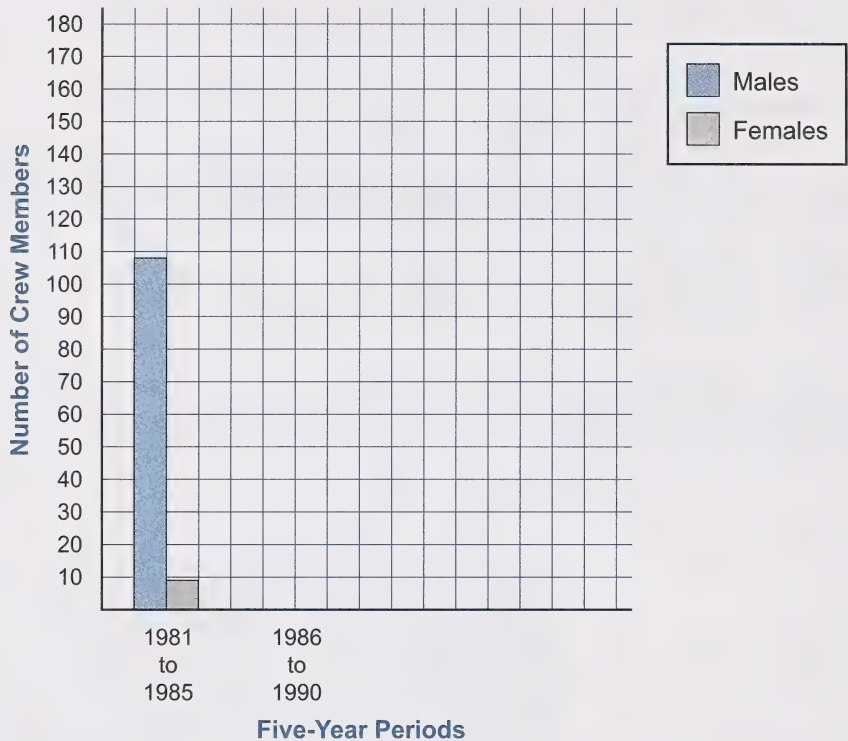
9. The total number of female crew members from 1981 to 2000 is about half of the number of male crew members for which five-year period?

10. Which five-year period has the greatest ratio of male to female crew members? Explain.

Check your answers on page 76 in the Appendix.

Sharing Time

Now it's time to show your home instructor what you have been learning.

Turn to page 70 of your Practice and Homework Book and complete questions 1 to 4.

Discuss your answers with your home instructor.

Activity 2
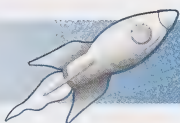
Today you will investigate stem-and-leaf plots.

Turn to page 164 of your textbook to Stem-and-Leaf Plots. Use the information given to answer questions 1 to 7.

1. Read the description of the data that Jose collected by measuring circumferences of trees.

   a. Which unit of length did Jose use to measure the circumferences of the trees?

   b. To what degree of accuracy did Jose round his measurements (to what nearest fraction of a unit)?
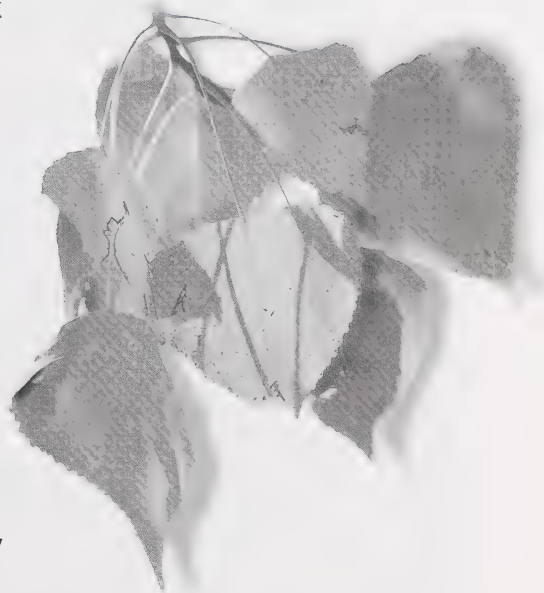
Often, **raw data** is written in the form of an **array**, like the one you see on the top of page 164.

2. Perhaps to begin with, Jose didn't know the exact number of trees he needed to measure. Assume that Jose measured the trees one at a time, and that he tried to write the numbers using complete rows and columns, as shown. Use the dimensions of the array of raw data to calculate and confirm the total number of trees Jose measured.

Check your answers on page 77 in the Appendix.

A **stem-and-leaf plot** is a table that organizes and displays a list of numbers according to size. It is a useful way to display numerical data because it gives a picture of the overall features of the data without losing the details about individual values.

Each value is broken into two parts: its stem and its leaf. The number of digits chosen for the stems depends on how the values are distributed. Notice in the following question that the stem of each number includes all but its last digit, and therefore the leaf of each number is a single digit.

3. Study the stem-and-leaf plot on page 164 that Jose used to display his data.

    a. Which part of each measurement is used for the stem?
    b. Which part of the measurements form the leaf?

Check your answers on page 77 in the Appendix.

4. a. How can you determine from the stem-and-leaf plot that there are 25 values in it?

b. Why is it important to compare your answers from question 2 and question 4.a., and what might you discover in doing so?

5. a. What is the greatest tree circumference and the least tree circumference?

b. Was it easier to find your answers to the previous question by looking in the array or in the stem-and-leaf plot? Explain.

6. Which value is in the middle position of the list in the stem-and-leaf plot? Explain how to find it.

7. Is there a tree circumference that occurs most frequently? Explain.

8. a. Which stem has the most leaves?
b. What does that tell you about the circumferences of the trees?

Check your answers on pages 77 and 78 in the Appendix.
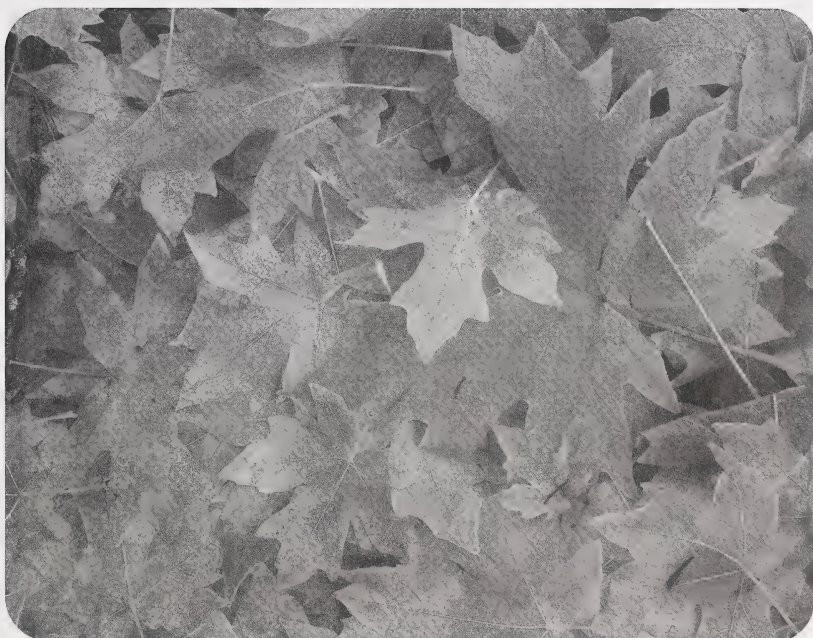
9. Casey's Candy Shop held a contest to guess how many jelly beans were in a glass jar. The guesses that were made are as follows: 253, 129, 271, 345, 136, 483, 225, 298, 305, 267, 456, 333, 345, 377, 525, 378, 387, 299, 400, and 350.
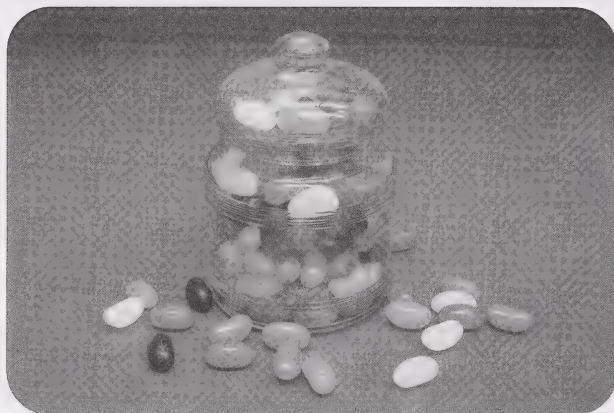
a. To make a stem-and-leaf plot, which part of the values seems best to use as the stems and which part of the values seems best to use as the leaves? Explain.

b. Make a stem-and-leaf plot of the values of the guesses.

c. Tell how you know that, in this case, there will not be a single value in the middle, and explain what the middle pair of guesses are.

Check your answers on page 78 in the Appendix.

Sharing Time

Now it's time to show your home instructor what you have been learning.
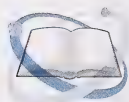
Turn to page 73 of the Practice and Homework Book and complete questions 1 and 2.

Discuss your answers with your home instructor.

Activity 3

Today you will learn how to use a stem-and-leaf plot to make a histogram.

A **histogram** is a bar graph in which there are no spaces between the bars. The bars represent consecutive intervals of values for continuous data, such as height, weight, or ages. (The bars do not represent separate objects, such as different cities.)
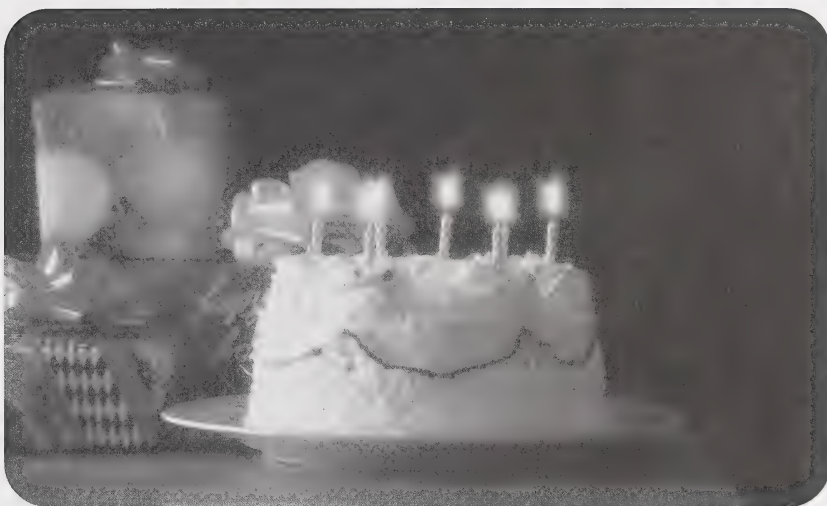
When Dinika went to her great-grandmother's 95th birthday, she surveyed all the guests and asked them how old they were on their last birthday. Dinika organized her data in the following stem-and-leaf plot.

Stem	Leaves
0	0 2 2 5 9
1	1 1 2
2	0 4 4 4 6
3	3 7
4	0 6 9
5	1 2 8
6	5 5 7 9
7	3 6 8
8	2 4
9	5

Imagine giving Dinika's stem-and-leaf plot a quarter turn counterclockwise.

Leaves										
9		6								
5		4				9				
2	2	4		9	8	7	8			
2	1	4	7	6	2	5	6	4		
0	1	0	3	0	1	5	3	2	5	
Stem	0	1	2	3	4	5	6	7	8	9

If you put the sideways stem-and-leaf plot on a grid, each leaf can be represented by a grid cell.

9		6								
5		4				9				
2	2	4		9	8	7	8			
2	1	4	7	6	2	5	6	4		
0	1	0	3	0	1	5	3	2	5	
Stem	0	1	2	3	4	5	6	7	8	9

If you erase the actual values of the leaves and the horizontal grid lines, you begin to make a bar graph called a histogram.
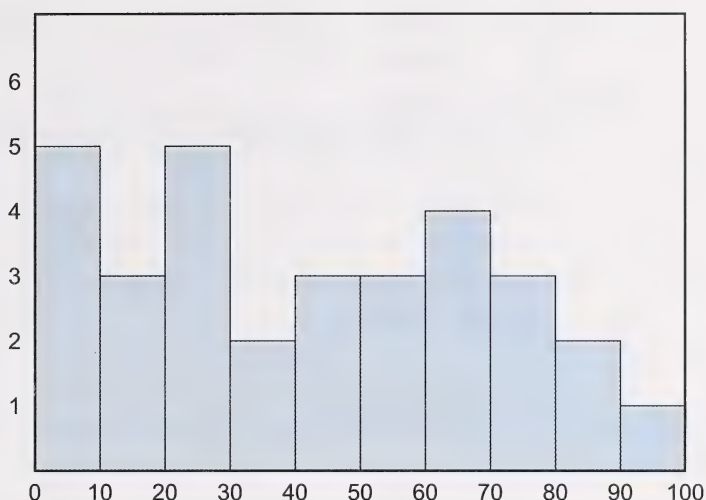
1. a. What does the height of each bar in the histogram show? Explain.

   b. What do the numbers going horizontally across the bottom of the histogram represent, and what pattern do you see?

   c. What would be a good title for the histogram?

The following statements summarize what you discovered by doing question 1.

> The vertical axis of a histogram is labelled with the word *frequency*.
>
> Each bar of a histogram is referred to as a **class** or an **interval**. The boundary values for the bars go up by common multiples so that all class sizes (or interval widths) are the same.
>
> Each histogram must include a title and its vertical and horizontal axes must be labelled appropriately.

2. Compare the stem-and-leaf plot and the histogram that represent Dinika's data.

   a. What information can you read from both displays?

b. What information is displayed in the stem-and-leaf plot that is not displayed in the histogram?

Check your answers on pages 78 and 79 in the Appendix.

The bars in a histogram have no spaces between them. Remember, each bar represents a range of values called an **interval** or **class**. Each interval includes the left (minimum value) endpoint, but **not** the right (maximum value) endpoint.

3. List the possible ages that could be represented by the bar with its left endpoint at 40 and its right endpoint at 50.

4. a. What is the youngest age and the oldest age that can be represented by this histogram?

b. How does the data collected by Dinika compare to your answers for question 4.a.?

Check your answers on page 79 in the Appendix.

GUESSES MADE ABOUT
THE NUMBER OF JELLYBEANS

5. Refer to the stem-and-leaf plot you made in question 9 of Activity 2. Using the same data and a grid like the one shown, complete a histogram. (Be sure to label it properly.)

0   100   200   300   400   500   600

Use your histogram to answer questions 6 to 9.

6. Put a mark along the horizontal axis of your histogram to represent (approximately) each of the following values.

   a. the least guess

   b. the greatest guess

   c. the guess (or guesses) closest to the middle

   d. The actual number of jellybeans in the jar was 372. Mark a red circle on the horizontal axis to represent this value.

7. a. How many guesses were less than the actual number?

   b. How many guesses were greater than the actual number?

   c. Which guess, the least guess or the greatest guess, is closest to the actual value? How much closer?

8. What does the shape of a histogram tell you?

9. What might you think about the data if

   a. the heights of all of the bars are similar?

   b. the heights of the bars are very different? (Some are quite tall and many are very short.)

   Check your answers on pages 79 to 81 in the Appendix.

Challenge Activity

Whitney read a statistics report that said the average life span is 78 years, and that over the course of a lifetime, 6 years are spent dreaming. If the dreams are spread uniformly over the years, by which birthday will Whitney have spent one year of her life dreaming?

Check your answer on page 81 in the Appendix.

Conclusion

In this lesson you investigated choosing and making appropriate data displays. You explored double-bar graphs, stem-and-leaf plots, and histograms.
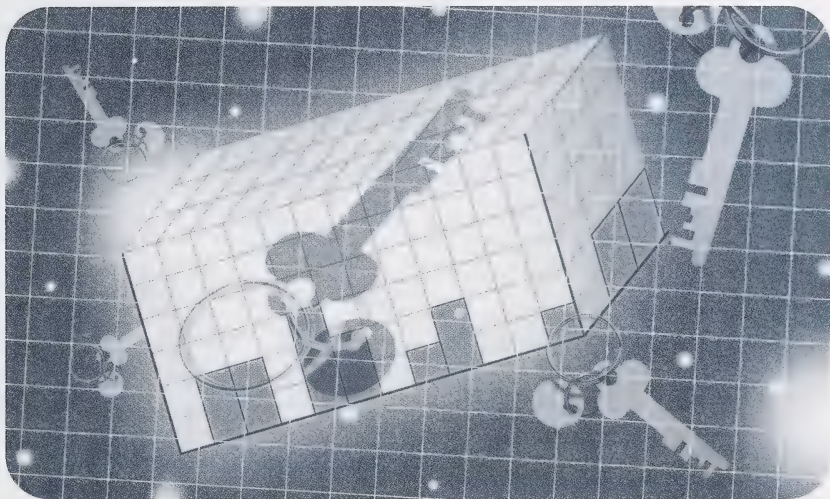
The graphs you explored in this lesson unlock the secrets of the data collected in surveys. Statisticians use graphs to present and make data understandable so that the people who use the data can make intelligent decisions. After the survey questions are asked and the data is collected, the data must be organized, displayed, and analysed.

Turn to Assignment Booklet 8A and complete
the Lesson 2 Assignment.

When you are done, send Assignment Booklet 8A to your teacher to be marked.
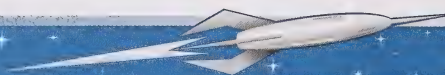
Comparing and Analysing Data

Suppose you are in the tourist industry and want to promote Banff as a tourist destination. You are planning to advertise in a golfing magazine and will be including one of the two photos shown above. Which of the two photos would you choose to make the best impression on the reader of the magazine?

Just as some pictures are more likely to influence travel decisions, some graphs are more appropriate for presenting data.

In this lesson you will compare a variety of ways of displaying data, and you'll consider the advantages of particular displays over others. You will analyse the displays to explore how they can be used to make decisions.

Activity 1

Today you will investigate different methods of collecting and displaying data.

Being accepted into the astronaut training program was one of the most exciting moments of my life!

NASA

Many qualifications are needed to become an astronaut: good health, the ability to live and work together with other people, and the ability to speak and understand English. One physical requirement is that an astronaut's height must be between about 152 cm and about 193 cm. At an astronaut reunion, Commander Claire took a poll by asking the astronauts in attendance for their heights. She made the following seven tables to collect and/or display the data.

TABLE 1: HEIGHTS OF A SAMPLE OF ASTRONAUTS (TO NEAREST CENTIMETRE)

16	3 8 9
17	0 0 0 3 3 3 3 4 5 5 5 5 8 8 8 8
18	0 0 0 0 0 0 3 3 3 3 3 3 3 3 3 3 4 8

TABLE 2: HEIGHTS OF A SAMPLE OF ASTRONAUTS

Height (to nearest centimetre)	Number of Astronauts	Frequency
160–164	/	1
165–169	//	2
170–174	‖‖ ///	8
175–179	‖‖ ///	8
180–184	‖‖ ‖‖ ‖‖ /	16
185–189	/	1

TABLE 3: HEIGHTS OF A SAMPLE OF ASTRONAUTS

Astronauts' Heights (in centimetres)
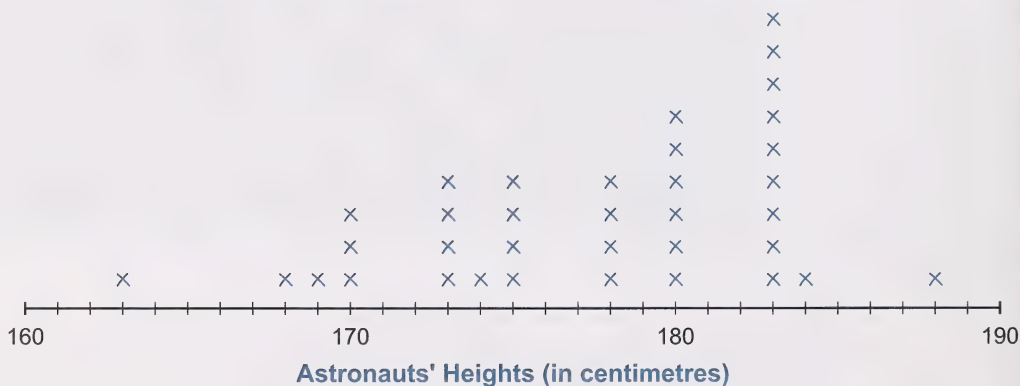
TABLE 4: HEIGHTS OF A SAMPLE OF ASTRONAUTS (TO NEAREST CENTIMETRE)

15	
16	9 3 8
17	5 0 0 3 0 3 5 5 4 3 8 3 5 8 8 8
18	0 3 3 0 8 3 3 0 4 3 3 3 3 0 0 0 3
19	

TABLE 5: HEIGHTS OF A SAMPLE OF ASTRONAUTS
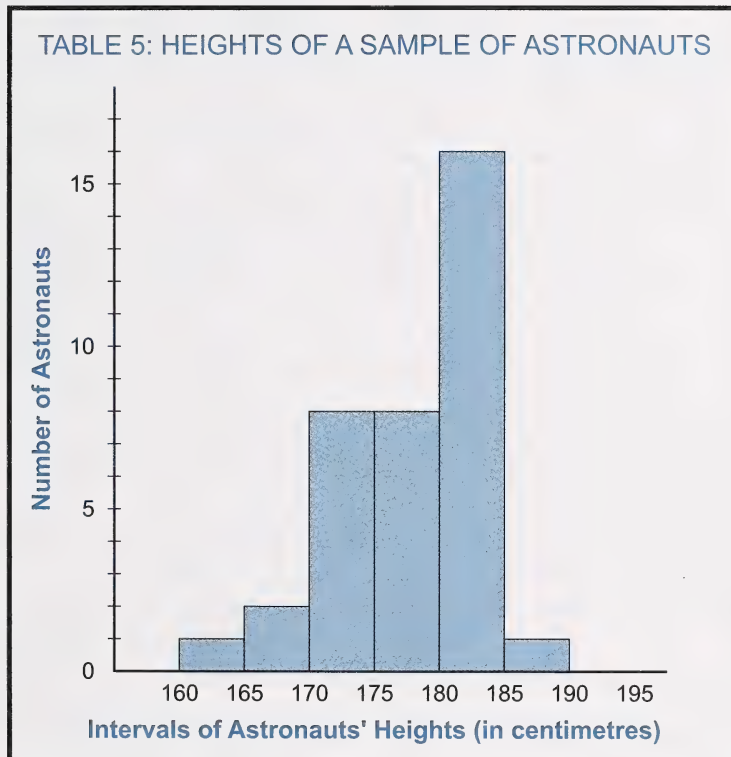
TABLE 6: HEIGHTS OF A SAMPLE OF ASTRONAUTS
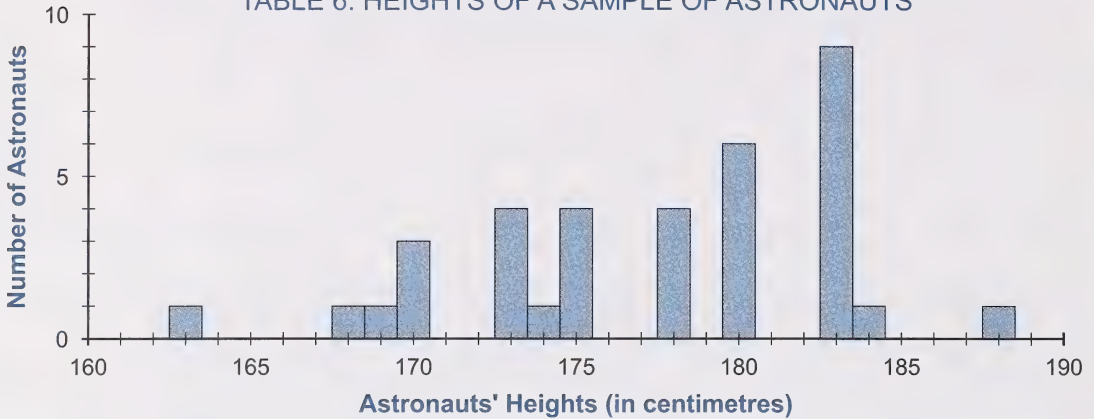
TABLE 7: HEIGHTS OF A SAMPLE OF ASTRONAUTS
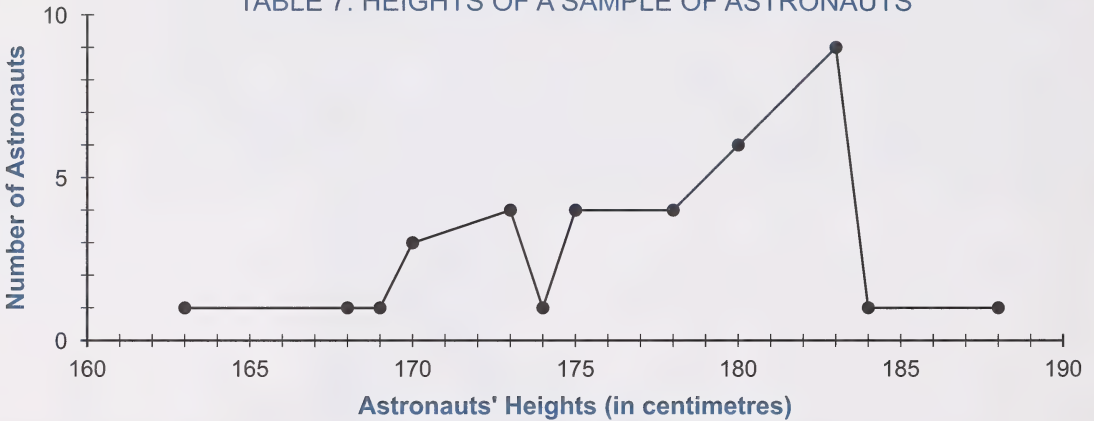
Use the tables to answer questions 1 to 9.

1. Which table did Claire likely use when she collected the data? Explain.

2. Explain how Table 1 is related to Table 4.

3. Compare Table 1 and Table 2. Which one of these tables can be used to make the other one? Explain.

4. Compare Table 1 and Table 3. Which of these tables can be used to make the other one? Explain.

5. a. What is the name of the data display in Table 5?

b. Which table is easiest to use to make the display in Table 5? Explain.

6. Compare Table 5 and Table 6.

  a. How are the displays the same?
  b. Which of these two displays show greater detail? Explain.
  c. Why are all of the bars touching in Table 5 but not in Table 6?

7. Explain how Table 3 (or Table 6) was used to make Table 7.

8. a. What is misleading about having the dots in Table 7 connected with lines? Explain.

b. What can be done to avoid this problem?

9. a. Which tables can be used to determine the number of astronauts in the sample?

b. How many astronauts were sampled?

c. In which tables can you identify the least height and the greatest height in the sample?

10. Suppose all of the astronauts in the sample were lined up in single file from shortest to tallest.

a. In which table can you most quickly identify the approximate heights of the astronauts standing in the middle of the line? Explain.

b. In which table can you most easily identify the exact height(s) of the astronaut(s) standing in the very middle of the line? Explain.

11. a. Write a question you can answer using Table 6 but not Table 2.

    b. Write a question that is easier to answer using Table 2 than by using Table 6.

Check your answers on pages 82 and 83 in the Appendix.

Activity 2

Today you will examine different ways of displaying data and decide which is most appropriate.

Data is usually collected to answer questions. In Activity 1 you saw that the same data can be displayed in many different ways. Keep in mind the question or questions you want to answer when you decide how to display the data that you collect.

Mitch found a recipe for apple pie that called for 9 apples. He bought a 4-kg bag of apples, but was not sure which apples to use because they varied quite a bit in size. His question is "What size is a typical apple?" He used a kitchen scale to find the mass, in grams, of each apple in the bag.

Mitch's results are shown in the following array.

141	98	200	174	188	92	129	225	88
156	209	150	163	89	219	107	175	95
213	110	125	209	95	148	192	135	90

Use these results to answer questions 1 to 9.

1. a. How many apples were in the bag?

    b. If you write the values in order from least to greatest, will there be a single value in the middle? Explain, and tell what it means to be the middle value.

2. What type of display is useful to sort the data so that it is easy to find the least value, the greatest value, and the middle value (or values)? Explain your reasoning.

3. Display the data using a stem-and-leaf plot. (List the leaves from least to greatest.) **Hint:** First decide whether it is most appropriate to use one digit or two for the stems.

4. Find the following masses and explain how you can use your display to find them.

    a. the lightest apple
    b. the heaviest apple

5. Use your strategy from question 1.b. to find the mass of the apple that is heavier than half of the apples and lighter than half of the apples.

6. What type of graph is useful to give an overall picture of how the values are distributed between the least and greatest values?

7. a. Make a table you can use to organize the data (to help you make a histogram in the next question). **Hint:** Group the data into intervals of equal size. (Use an appropriate common multiple.)

   b. Use the table you made in question 7.a. to make a histogram.

8. Fruits, such as apples, are often graded using the size categories of small, medium, and large.

   a. Decide on an appropriate way to make three different categories of sizes, and show it in your graph.

   b. Which of your size categories has the most apples?

9. Which apples would you suggest that Mitch use to make his pie? Explain.

10. a. Instead of calling for 9 apples, how else might the recipe have described that amount of apples? Explain.

    b. Use your answer to question 10.a. to suggest a different way Mitch could have chosen the appropriate amount of apples.
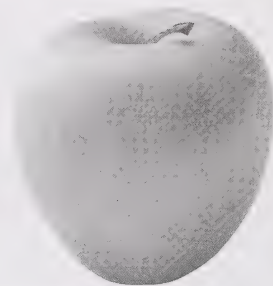
Check your answers on pages 83 to 86 in the Appendix.

Activity 3

T oday you will make decisions on the basis of data displayed in graphs.

Turn to pages 148 and 149 in your textbook. The picture on pages 148 and 149 shows the equipment rental shack at the Clear Lake Winter Fun Centre, where Sigurd works during the winter season. The manager asked Sigurd to collect data that can be used to make decisions about what equipment they should make available for rent next winter.

Using the data he collected, Sigurd made three graphs and presented them to his manager. His graphs are shown on pages 150 and 151 in the textbook. Use them to answer questions 1 to 9.

1. Look at the circle graph at the top of page 150.

    a. What population do you think the data was collected from?

    b. How do you suppose Sigurd collected the data he used to make the circle graph?

2. Explain how you can answer the following questions without using a protractor.

    a. What fraction of the circle represents skating?

    b. Which other sport is represented by the same fraction as skating?

    c. What reasoning might Sigurd have used if he claimed that the tobogganing sector is three-eighths of the circle?

3. a. Do the sizes of the sections in the circle graph match the numbers of people doing the different activities shown in the picture on pages 148 and 149?

    b. Give reasons why this might be so.

    c. What information might Sigurd have included on his circle graph to make it more meaningful? Explain.

    d. What kind of decisions might be made from the circle graph?

4. Look at the line plot at the bottom of page 150. Suppose this display represents the rentals for one day.

   a. How does the data in the line plot compare to the numbers of people doing the different activities shown in the picture on pages 148 and 149?

   b. Give reasons why this might be so.

5. a. For which activity do the data from the line plot and the circle graph seem most different? Explain.

   b. Give reasons why this might be so.

6. What kind of decisions might be made from the line plot?

Check your answers on page 88 in the Appendix.

7. Look at the broken-line graph at the top of page 151.

   a. Are some of the winter activities likely to be more affected by the temperature than others? Explain.

   b. What other weather conditions are important for winter activities? Explain.

   c. What kind of decisions might be made from the broken-line graph?

8. Look at the picture on pages 148 and 149.

   a. What other equipment might people at the centre like to rent or buy?

   b. How might Sigurd collect data to help him answer question 8.a.?

9. What recommendations might Sigurd make to his manager for the next winter season?

Check your answers on page 89 in the Appendix.

Poppy's Pizza offered free samples to their customers to help them decide which of three new kinds of pizza would likely be most popular, Super Salami, Very Veggie, or Tasty Taco. Sixty people tried Super Salami, 66 people tried Very Veggie, and 86 people tried Tasty Taco. Twenty-one people tried both Super Salami and Very Veggie, 29 people tried both Very Veggie and Tasty Taco, and 32 people tried both Tasty Taco and Super Salami. Nine people tried all three kinds. How many people tried the new kinds of pizza?

Check your answer on pages 89 and 90 in the Appendix.

Conclusion

In this lesson you compared a variety of data displays and considered the advantages of particular displays. You analysed the displays to understand what questions might be answered with the data.

Being able to read graphs and charts or use them to display information to colleagues is an important skill for people in the business community. Selecting the most appropriate way of presenting data is critical if the businessperson needs to persuade or influence clients or colleagues. If your future leads you into a business-related career, you will likely use the skills you developed in this lesson.

Turn to Assignment Booklet 8B and complete
the Lesson 3 Assignment.

Keep Assignment Booklet 8B until you have completed the entire booklet.

Module Summary

In Module 8 you reviewed methods for forming questions that can be investigated. You extended your knowledge for choosing appropriate data sources, selecting representative samples, and collecting data to answer questions.

You learned more about choosing and making appropriate data displays. You were introduced to double-bar graphs, stem-and-leaf plots, and histograms.

You compared a variety of data displays and considered the advantages of particular displays. You analysed the displays to understand what questions can be answered with the data.

The survey techniques you explored in this lesson are used by the employees of Statistics Canada. Statistics Canada was created by an act of Parliament to collect information about Canada's people, economy, resources, and culture. Perhaps your future career will involve using the information Statistics Canada gathers.

Turn to Assignment Booklet 8B and complete the Numbers in the News project.

When you are done, send Assignment Booklet 8B to your teacher to be marked.

Keystrokes
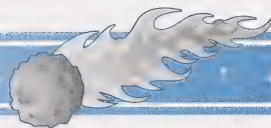
Take out your calculator and complete the following exercises. They will help you review some of the ideas you have learned in Module 8.

Funky Feature: Think in Threes

Try the following:

- Write any whole number with any number of digits. For example, try 98 647.

- Add the digits of the number.

    $9 + 8 + 6 + 4 + 7 = 34$

- Is the sum divisible by 3?

    $34 \div 3 = 11 \text{ R1}$

    No, the sum is not divisible by 3.

- Use your calculator. Is the whole number you started with divisible by 3?

    $98\ 647 \div 3 = 32\ 882 \text{ R1}$

    No, the number is not divisible by 3.

1. Create your own sample of ten numbers from the population of all whole numbers (any number of digits) and write them in a table like the following.

Whole Number	Sum of Digits	Is the Sum Divisible by 3?	Is the Whole Number Divisible by 3?

2. Did you find a pattern in your answers? If so, describe the pattern. If not, try more numbers until you see a pattern.

3. Predict if the pattern you found will be true for all whole numbers.

4. Explain why the pattern works. (**Hint:** Use base ten blocks to model three-digit and four-digit numbers. What remainders do you get when you divide each 10, 100, and 1000 by 3?)

Funky Feature: Date Square

5. Use the following calendar for April 2003.

   a. Draw a box around any group of 16 numbers that form a 4-by-4 array.

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

   b. Find the sum of the four dates in the corners of the array, and then multiply the sum by 4.

   c. Find the sum of all 16 dates in the array. What do you notice?

6. Choose a sample of several calendars for any months of any years, and repeat the process from question 5. What do you notice?

7. Predict if the pattern you found will be true for the population of all calendars.

Check your answers on pages 90 to 92 in the Appendix.

Review
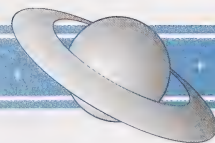
The activities in this lesson will help you review and apply what you learned in Module 8 and prepare for the final test. Discuss with your home instructor when you should begin the Review and how much of the Review you should complete.

1. You are the publicity chairperson of your 4-H Club. Without asking all 30 members, you want to get an idea of which one of the available styles of t-shirts the club members prefer. Explain why each of the following is or is not a good way to select a representative sample of members.

   a. your four best friends
   b. four girls
   c. four boys
   d. the first four names in an alphabetical member list
   e. four people sitting near you

2. How might you pose a question to collect data for the survey in question 1?

3. Turn to page 153 of your textbook. Do questions 1 to 5 of Practise Your Skills.

If you need help with questions 1 to 3, look back at Lesson 1, where you learned about selecting samples and making surveys. If you feel you need more practice, do question 4.

4. Turn to page 203 of your textbook. Do question 4 of Skill Bank Looking Back.

Check your answers on pages 92 to 94 in the Appendix.

5. Turn to page 162 of your textbook. Do question 1 of On Your Own.

6. Turn to page 174 of your textbook. Do question 3.a. of Skill Bank from This Unit.
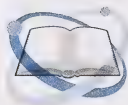
7. Turn to page 163 of your textbook. Do question 3 of On Your Own.

If you need help with questions 5 to 7, look back at Lesson 2, where you learned about making double-bar graphs, stem-and-leaf plots, and histograms. If you feel you need more practice, do questions 8, 9, and 10.

8. Turn to page 223 of your textbook. Do question 2 of Skill Bank Looking Back.

9. Turn to page 203 of your textbook. Do question 6 of Skill Bank Looking Back.

10. Turn to page 163 of your textbook. Do question 1 of Practise Your Skills.

Check your answers on pages 94 to 97 in the Appendix.

11. Turn to page 160 of your textbook to Practise Your Skills. On the first day of the month, the manager of a video store randomly selected 30 customers and asked them how many movies they had rented during the past month. The manager made the line plot with the data. Use it to answer questions 1 to 3 on page 160.

12. Turn to page 161 of your textbook to Double-Bar Graphs. Do questions 1 to 4.

13. Turn to page 162 of your textbook. Do question 2 of On Your Own.

14. Turn to pages 146 and 147 of your textbook. Use the graphs shown to answer the following questions.

    a. What information is missing from the broken-line graph called Price of Computers?

    b. What information is missing from the bar graph called Sales of Video Cassettes?

    c. What else would you like to know about the data in the line plot called Number of Movies Rented by Students in March?

d. What information is missing from the stem-and-leaf plot called Heights of School Basketball Players?

e. Where might the researchers have gone to select the sample to get the data for the double-bar graph called Average Masses of Girls and Boys?

15. Turn to pages 158 and 159 of your textbook.

   **a.** Do questions 1 to 5 on page 158.
    b. Do question 1 on page 159.

If you need help with questions 11 to 15, look back at Lesson 3, where you learned about comparing and analysing data. If you feel you need more practice, do questions 16 and 17.

16. Turn to page 203 of your textbook. Do question 5 of Skill Bank Looking Back.

17. Turn to page 223 of your textbook. Do question 3 of Skill Bank Looking Back.

Check your answers on pages 98 to 100 in the Appendix.

18. Turn to pages 171 to 173 of your textbook. Do questions 6 to 10 of Problem Bank.

Check your answers on pages 101 to 103 in the Appendix.

If you need additional work to master the material in this module, work through Lesson 10: Understanding and Interpreting Graphs on the Mathematics 6 Companion CD.

After this lesson, you can print out an assignment by clicking on the Activity button at the bottom of the page.

Ask your home instructor to print the solutions to the questions in the activity by clicking on the Parent Notes button at the bottom of the page. Discuss your answers with your home instructor.

Just the Facts

Ask your home instructor to time you as you complete the following timed drill. Your goal is to complete all 25 questions in two minutes. At the end of two minutes, count how many questions you were able to complete. Then use the Answer Key in the Appendix to mark the drill, and record your score in the space provided. Before you move on, go back and complete any questions you did not finish.

Multiplication and Division Facts

$1 \times 3 =$	$15 \div 5 =$	$\begin{array}{r} 3 \\ \times 4 \\ \hline \end{array}$	$2\overline{)16}$	$7 \times 9 =$
$0 \div 8 =$	$\begin{array}{r} 6 \\ \times 7 \\ \hline \end{array}$	$6\overline{)54}$	$2 \times 5 =$	$72 \div 8 =$
$\begin{array}{r} 7 \\ \times 0 \\ \hline \end{array}$	$5\overline{)10}$	$9 \times 2 =$	$7 \div 7 =$	$\begin{array}{r} 1 \\ \times 6 \\ \hline \end{array}$
$3\overline{)15}$	$8 \times 8 =$	$7 \div 1 =$	$\begin{array}{r} 5 \\ \times 3 \\ \hline \end{array}$	$4\overline{)24}$
$5 \times 7 =$	$54 \div 9 =$	$\begin{array}{r} 0 \\ \times 7 \\ \hline \end{array}$	$7\overline{)28}$	$8 \times 4 =$

Multiplication and Division Facts

Number completed in 2 minutes: ⬚⬚⬚⬚⬚
Number correct in 2 minutes: ⬚⬚⬚⬚

Record your score on the Just the Facts Progress Chart.

Mental Math
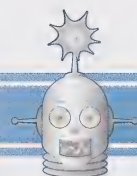
Sometimes you may find it helpful to use addition when you need to subtract! This tip can be especially handy when you are subtracting mentally.

To understand the idea behind this strategy, study the following subraction questions.

$$
\begin{array}{r} 8 \\ -\ 3 \\ \hline 5 \end{array}
\qquad
\begin{array}{r} 18 \\ -\ 13 \\ \hline 5 \end{array}
\qquad
\begin{array}{r} 108 \\ -\ 103 \\ \hline 5 \end{array}
$$

Notice that when you add the same amount to both the top number (the **minuend**) and the bottom number (the **subtrahend**), the answer (the **difference**) stays the same.

Example 1

Dmitri found the exact model of bicycle he wanted at two different stores. At one store, it cost $432. At the other store, it cost $394. What is the difference between these two prices?

Add a number to the subtrahend to make the tens and ones digits zeros, and add the same number to the minuend. This makes the numbers easy to subtract.

$$
\begin{array}{r}
432 \rightarrow +\,6 = 438 \\
-\,394 \rightarrow +\,6 = -\,400 \\
\hline
38
\end{array}
$$

The bicycle costs $38 more at the first store.

Example 2

As Becki's family drove out of town, she saw a road sign that said it was 604 km to Slave Lake, which was where they were going. Later, she read another road sign that said it was 389 km to Slave Lake. How far is it between the two road signs?

$$
\begin{array}{r}
604 \rightarrow + \, 11 = 615 \\
\underline{- \, 389 \rightarrow + \, 11 = - \, 400} \\
215
\end{array}
$$

The two road signs are 215 km apart.

Try to practise this strategy whenever it is appropriate to use it.

Mathematics 6

Appendix

Glossary
Answer Key
Image Credits
Learning Aids
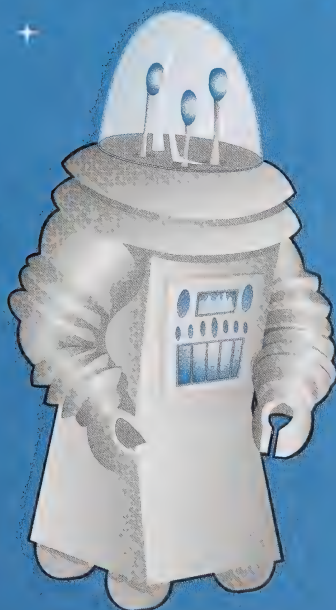
Glossary

array: data organized in a table or in rows and columns

broken-line graph: a graph formed by joining points on a grid

class: interval

data: information obtained through a survey or experiment

double-bar graph: a bar graph comparing two sets of data

first-hand data: data that you collect directly from the original source

frequency: the number of times a value occurs in a data set

histogram: a bar graph showing the frequency of data in consecutive intervals

interval: the width of a bar in a histogram

line plot: a graph for organizing data consisting of a number line and marks above the number line for each value in the data set

median: middle value

middle value: the value in a set of data for which the number of data less than this value is equal to the number of data that are greater than this value

population: all the people or objects being considered

random sample: a sample for which each member of the population had the same chance of being selected

range: the difference between the largest and smallest values in a set of data

raw data: data that has been collected but not organized or analysed

representative sample: a sample that closely resembles the population

sample: the part of the population surveyed

second-hand data: data that others collect

stem-and-leaf plot: a graph that organizes and displays numerical data according to size

survey: the process of obtaining information from a sample

Answer Key

Lesson 1: Surveys and Samples

Activity 1

1. The population about which Commander Claire wants information consists of all the astronauts that have participated in the Space Shuttle program since 1981.

2. She may have decided to ask her fellow crew members because she found it convenient to do so. They were all right there on the space station with her.

3. Claire might list the cereals on a tally chart and then ask each astronaut which one of these types of cereal is his or her favourite. As they answer, she can put a tally mark in the correct spot. Afterwards, she can count up how many tally marks each cereal received.

4. Answers will vary. Sample answers are given.

   - Commander Claire may go through the records and systematically pull data by putting a tally mark beside the cereal that was the most popular on every tenth mission.

   - Commander Claire may tally the most popular cereal for just the last thirty missions.

5. a.

Cereal	Tally of Favourite Cereal	Number of Votes
Bran Wafers	### //	7
Korn Flakes	### ### ###	15
Granola	### ///	8
Grits	///	3
Oatmeal	###	5
Crispy Rice	### ### //	12

   b. The cereals from most favourite to least favourite are Korn Flakes, Crispy Rice, Granola, Bran Wafers, Oatmeal, and Grits.

c. No, the table does not tell how many boxes of Crispy Rice were eaten aboard the previous 50 Space Shuttle missions. It only tells that more boxes of Crispy Rice were eaten than any other cereal on 12 of the last 50 missions.

6. a. Yes, the size of the sample seems appropriate. (Fifty missions sampled from a total of about 100 missions is about half the missions.)

b. The sample used in question 5 is likely representative of the population described in question 1 because the past 50 missions date back a long time (almost 10 years); and, as pointed out in the previous question, the fraction of missions sampled is large enough.

c. No, the sample taken aboard the space station is not a good representation of the population. By asking only one crew of astronauts out of several hundred astronauts is much too small a sample.

7. Answers will vary. A sample answer is given.

Claire may select a different sample from the one used in question 5 by trying to telephone or e-mail her question to all past and present shuttle astronauts using a database from the space centre.

8. Answers will vary. Sample answers are given.

Factors that might affect the results of Claire's first-hand survey in question 7 that wouldn't affect the results of her second-hand survey in question 5 include the following:

- For different reasons, some astronauts may not return their surveys. For example, they may not bother to return the e-mail or they may have a different telephone number than the one Claire has, making it impossible to contact them.

- If their mission was several years ago, they may not remember what they ate.

- Some astronauts may not want to participate in the survey.

9. The space centre might use the results of Claire's investigation to predict the quantities of each type of cereal they may need for future missions.

Activity 2

1. a. The ad suggests that the claim applies to the population of all dentists.

   b. The ad suggests that all dentists were asked, and that three-fourths of them recommend Tasty Tooth Paste. This is not likely. It would be very time-consuming and costly to attempt to contact every dentist in the country. Besides, it is very unlikely that every dentist would be willing to respond. Some may not have even heard of Tasty Tooth Paste.

2. a. The ad suggests that the claim applies to all people in Canada.

   b. Only people between 18 and 25 years of age were surveyed, and this age group only represents one segment of the population. People in this age group may prefer different types of pizza than people in other age groups.

3. a. The ad suggests that the claim applies to all children in Canada between 10 and 12 years of age.

   b. "Most popular" likely means that more children between 10 and 12 years of age choose that brand of bicycle than any other particular brand. Because of the number of different brands, the proportion choosing this brand may very well be less than half the total population. However, many people reading the ad may wrongly assume that more than half of the children between 10 and 12 years of age choose this brand.

   c. You could find out how many Canadian children are in that age range by using Statistics Canada data. You could visit the Statistics Canada website.

   http://www.statcan.ca/english/Pgdb/demo10a.htm

   In 2002, there were about 2 100 000 children in the 10–14 age range.

4. a. *Majority* means more than half of the doctors who use hand lotion.

b. Questions that may have been asked include the following:

- "Do you use hand lotion?" (If they answer yes, they can be included in the sample.)

- "If you said yes, what hand lotion do you use?" (Record the answers to this question as data.)

c. If the company included a stamped envelope to return the survey, doctors might be more likely to answer the question and send it back. If the company sent along free hand lotion, doctors might be more likely to answer that they prefer Oceans of Lotion.

5. a. The ad suggests the claim applies to people who eat cookies.

b. They may want to know how many people were sampled, how the sample was chosen, and how the data was collected. For example, people in the sample may have been given a taste test using only two kinds of cookies: Crunchies that are fresh from the pack and mouldy, stale Brand X cookies that only a starving rat would touch.

6. a. The ad states that the claim applies only to the people who took part in the taste test.

b. The ad for Loco-Cocoa is similar to the ad for Tasty Tooth Paste in that they both state a specific proportion of people who prefer their products. It is different because Loco-Cocoa only claims their product is preferred over one other brand for just the sample of people surveyed, while the Tasty Tooth Paste ad makes its claim against all competitors for the population of all dentists.

7. a. Cherinna might predict that about 220 of the 400 spectators would prefer red gumdrops. (220 is a bit more than half of 400; or $8 \times 50 = 400$ and $8 \times 28 = 224$.)

b. This prediction is likely reasonable because Cherinna's sample is likely representative of the population.

8. a. Garth may have multiplied 6×7 to predict he would have 42 customers in an hour. (There are six ten-minute periods in one hour.) Then he may have multiplied 4×40 to get 160 customers in his four-hour shift.

b. This prediction is not likely reasonable because 10 min is not a very long period of time, and it may not be typical of what might happen throughout Garth's shift.

- Maybe his shift started at the peak of the lunch-hour rush. It likely wouldn't stay that busy.

- Perhaps the orders he received were small so he was able to serve more customers in 10 min than usual.

- He never factored in his break time when he wouldn't serve any customers.

9. In order to select a representative sample, it is most important for you to keep the following in mind:

- the size of the sample compared to the size of the population
- the characteristics of the sample compared to those of the population
- the methods used to select the sample

Activity 3

1. a. It is hard to predict which thumb you would put on top because you might never have thought about it before. This investigation only works if you clasp your hands without thinking about it.

b. It feels a little strange when you purposely put the opposite thumb on top.

2. The directions used in the survey may be as follows:

- Quickly clasp your hands together by interlocking your fingers.
- Look to see which thumb is on top, your left thumb or your right thumb.

3. Answers will vary. Sample answers are given.

a. People surveyed may include friends; relatives; parents' co-workers; or people in line at the store, bank, or movie theatre.

b.

	Tallies for Males	Tallies for Females
Left Thumb on Top	ⅢⅡ	Ⅲ
Right Thumb on Top	Ⅲ Ⅲ |||	Ⅲ Ⅲ Ⅲ

4. Answers will vary. The given answer is based on the sample answer to question 3.b.

	Tallies for Males	Tallies for Females	Total People
Left Thumb on Top	7	5	12
Right Thumb on Top	13	15	28
Total People	20	20	40

5. Answers will vary. The given answers are based on the sample answer to question 4.

   a. About twice as many people put their right thumb on top.

   b. The results do not show much difference between males and females. Both groups put their right thumb on top more than their left thumb. However, the females surveyed put their right thumb over their left thumb in a 3-to-1 ratio; whereas the males put their right thumb over their left thumb in about a 2-to-1 ratio.

6. The population from which your sample is taken is people in general.

7. The results from question 7 compare with the results from question 4 in the following ways:

   • The results of both surveys show that more people (and more females) put their right thumb on top.

   • The results from question 7 show more of an equal split among males than the results from question 4, which show that more males put their right thumb on top.

8. The results from question 7 can be used to make the following predictions:

   a. A little less than half the people in the population will put their left thumb on top.
   b. A little more than half the people in the population will put their right thumb on top.

9. No, you can't always accurately predict that something will be true for a population just because it is true for a sample of that population. It depends on the size of the sample (The larger, the better.) and on how well the sample represents the population. However, if the sample is large enough and it is representative of the population, there is a high likelihood that an accurate prediction of the population can be made from the results of the sample.

Challenge Activity

There are four boys and three girls in the family. You can get the answer by using a guess-and-test strategy.

- If Kris has one brother and one sister, then there are two boys and one girl in the family. (This won't work because Lily has at least one sister.)

- If Kris has two brothers and two sisters, then there are three boys and two girls in the family. (This won't work because then Lily will have three times as many brothers as sisters.)

- If Kris has three brothers and three sisters, then there are four boys and three girls in the family. (This will work because then Lily will have twice as many brothers as sisters.)

Lesson 2: Displaying Data

Activity 1

1. In the time period from 1961 up to the first moon landing, the Americans made ten more human spaceflights in total than the Russians. The Americans made a total of 22 human spaceflights and the Russians made a total of 12 human spaceflights.

2. The Russians and the Americans made the same number of human spaceflights in 1961 and in 1967.

3. The Russians made more human spaceflights than the Americans in 1963 and 1964.

4. By the end of 1964, the Russians made more human spaceflights in total than the Americans.

5. The Americans made almost half of their human spaceflights in the two-year period from 1965 to 1966. ($5 + 5 = 10$, out of a total of 22 human spaceflights)

6. In 1964 and 1966, only one nation made a human spaceflight. In 1964, it was the Russians; and in 1966, it was the Americans.

7. Answers will vary. A sample answer is given.

   Questions 2 to 6 were most easily answered using the double-bar graph because the answers can be found by making visual comparisons.

8. Your graph should be similar to the one that follows.

NUMBER OF MALE AND FEMALE CREW MEMBERS ON SPACE SHUTTLE MISSIONS
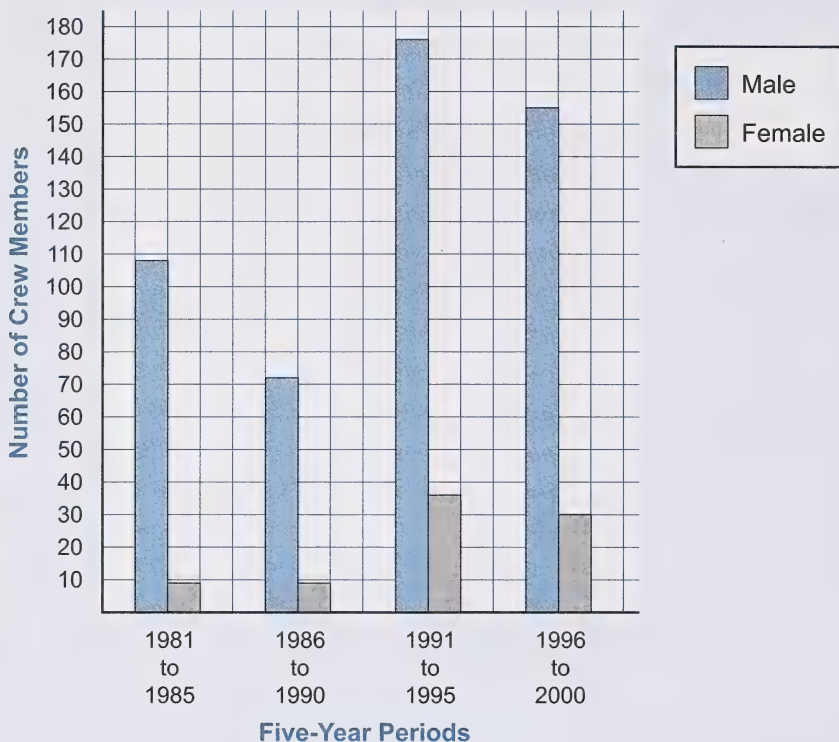
9. The total number of female crew members from 1981 to 2000 is about half of the number of male crew members for the five-year period from 1991 to 1995.

10. The five-year period from 1981 to 1985 has the greatest ratio of male to female crew members. In fact, there were more than 10 times as many male crew members as females.

- From the table, $12 \times 9 = 108$.

- From the graph, almost 11 blocks were used to represent males, compared to not quite 1 full block to represent females.

Activity 2

1. **a.** Jose used centimetres to measure the circumferences of the trees.

   b. Jose rounded the measures of the circumferences to one decimal place, the nearest tenth of a centimetre (which is to the nearest millimetre).

2. Jose measured a total of 25 trees. Solutions may vary. Sample answers are given.

   $7 \times 3 = 21$ and $21 + 4 = 25$ trees   or $7 \times 4 = 28$ and $28 - 3 = 25$ trees

3. **a.** The stem is the whole number of centimetres (the first two digits) of each measured circumference.

   b. The leaf is the last digit (the tenths of centimetres) of each measured circumference.

4. **a.** You can count the number of leaves to determine the total number of values in the plot.

   b. The number of values in the array must equal the number of leaves in the stem-and-leaf plot because each number in the array also gets recorded in the plot.

   If you find more values in the array, you may have missed recording that many values in the plot. If there are less values in the array, you may have accidentally recorded a value from the array more than once in the plot.

5. **a.** The data ranges from a minimum of 75.6 cm to a maximum of 83.4 cm.

   b. It is easier to find the greatest and the least numbers by looking in the stem-and-leaf plot because the numbers in it are listed in order; whereas in the array, the sizes of the numbers are all scattered around. In Jose's plot, the least number is shown by the first leaf in the top row of the plot. The greatest value is shown by the last leaf in the bottom row of the plot.

6. The value 79.5 is in the middle position. Out of 25 values, twelve numbers must come before it and twelve numbers must come after it. So, counting either from top to bottom or from bottom to top, the middle value must be in the thirteenth spot, which is the second of the two 79.5 values listed.

7. There are four tree circumferences that each occur twice. These measures are 77.5 cm, 79.0 cm, 79.5 cm, and 79.9 cm. No value occurs more often than twice, or else it would quickly show up in the list of leaves as being a digit repeating at least three times in a row.

8. a. The stem 79 has the most leaves.

   b. It means that more trees (nine trees) have circumferences between 79 cm and 80 cm than between any other pair of consecutive whole-number measures.

9. a. Given that the values range from 129 to 525, it is most appropriate to use the hundreds digit to form the stems and the rest of the number (the tens and ones digits together) to form the leaves. That way, you will have a manageable number of stems (five different stems) and a reasonable number of leaves in each stem (a minimum of one leaf and a maximum of eight leaves).

   b.

| Stem	Leaves
1	29 36
2	25 53 67 71 98 99
3	05 33 45 45 50 77 78 87
4	00 56 83
5	25

   c. There is no single value in the middle because there is a total of twenty values (an even number). This means that as you count down from the top and up from the bottom, you will work towards a pair of numbers in the middle. If you cross off the nine highest and nine lowest leaves, you are left with the tenth and the eleventh values in the list. Therefore, the middle two guesses are 333 and 345 jellybeans.

Activity 3

1. a. The height of each bar shows the frequency (the number of leaves in the range of values for each stem). Each grid cell represents a leaf, so you count the number of cells in each bar to find the number of leaves (its frequency).

   b. The numbers going vertically across the bottom of the histogram refer to the ages of the people (on their last birthday) at the party, and they increase in intervals of ten years.

   c. A good title for the histogram is Ages of the Guests at Grandma's Party.

2. **a.** Both displays show the number of values in each bar (class or interval).

   b. The stem-and-leaf plot shows all the actual values, but the histogram just shows how many values there are in each interval.

3. The possible ages that could be represented by the bar with its left endpoint at 40 and its right endpoint at 50 are 40, 41, 42, 43, 44, 45, 46, 47, 48, and 49.

4. **a.** The youngest age that can be represented by this histogram is 0 years (a baby who has not yet celebrated his or her first birthday). The oldest age that can be represented by this histogram is 99 years.

   b. Not all ages represented by the boundaries of the histogram show up as data, but each age belongs inside one interval.

5.

GUESSES MADE ABOUT
THE NUMBER OF JELLYBEANS
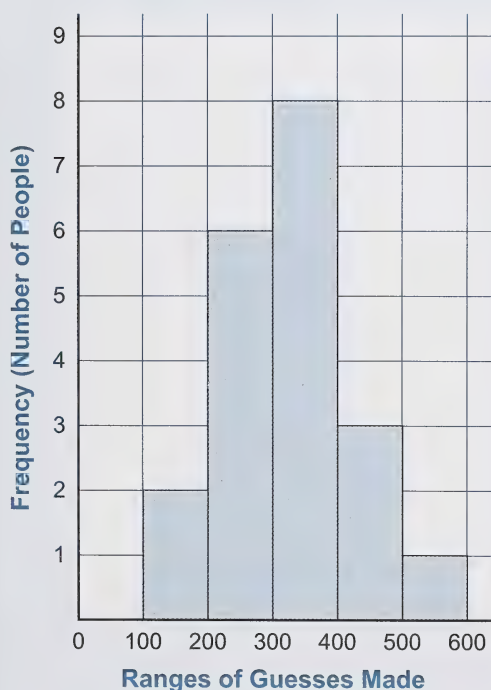
6.

GUESSES MADE ABOUT
THE NUMBER OF JELLYBEANS
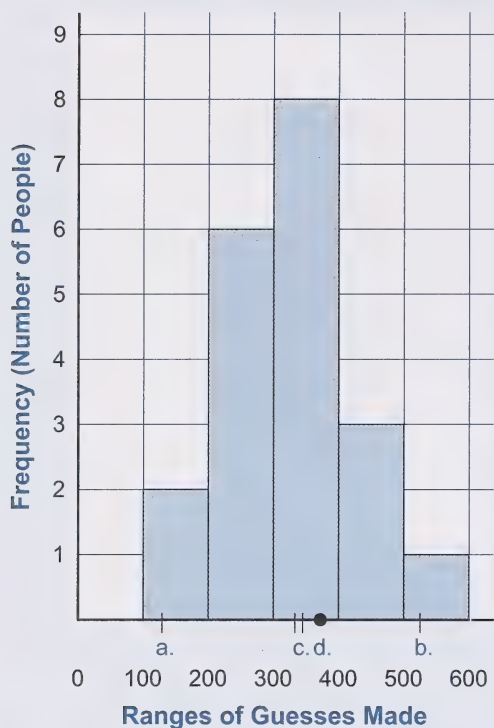
a. 129 jellybeans
b. 525 jellybeans
c. 333 and 345 jellybeans
d. 372 jellybeans

7. a. Thirteen guesses were less than the actual number.

   b. Seven guesses were greater than the actual number.

   c. The greatest guess is closer by 90 to the actual value than is the least guess.

       • Least guess: $372 - 129 = 243$ jellybeans too low
       • Greatest guess: $525 - 372 = 153$ jellybeans too high
       • $243 - 153 = 90$ jellybeans closer

8. The shape of a histogram can help you visualize the distribution of the data. You can compare the frequencies of the intervals by comparing the heights of the bars. You can see which values are represented by the tallest bars.

9. a. The values are somewhat evenly distributed in size over the range of the data.

    b. The values are clustered in size. (Most are between the boundaries of the tallest bars.)

Challenge Activity

Whitney will have spent one year dreaming on her thirteenth birthday.

- $78 \div 6 = 13$. That means that $\frac{1}{13}$ of each year is spent dreaming.

- Thirteen groups of $\frac{1}{13}$ of a year will total 1 year of dreaming, so it will take 13 years to have dreamt for one whole year.

Lesson 3: Comparing and Analysing Data

Activity 1

1. Claire likely used the stem-and-leaf plot in Table 4 when she collected the data. She wrote on the plot all the stems that she thought were likely to appear, and then she added the leaves in the order that she collected the data.

2. The stem-and-leaf plot in Table 4 can be used to make the stem-and-leaf plot in Table 1. Both contain all the actual values, but the unused stems of Table 4 have been left out in Table 1. Also in Table 1, the leaves for each stem from Table 4 have been arranged in order from least to greatest.

3. Table 1 can be used to make Table 2. The leaves from each stem in the plot in Table 1 form two intervals in Table 2. The leaves from 0 to 4 form one interval and the leaves from 5 to 9 form the next interval. **Note:** Table 2 cannot be used to make Table 1 because Table 2 does not show the actual values.

4. Table 1 can be used to make Table 3 or Table 3 can be used to make Table 1. You can read all the actual values in both the stem-and-leaf plot in Table 1 and the line plot in Table 3.

5. **a.** The data display in Table 5 is a histogram.

   b. Table 2 is easiest to use to make the histogram in Table 5. The intervals in the histogram are the same as those in Table 2.

6. **a.** The displays in Table 5 and Table 6 are both bar graphs.

   b. Table 6 shows greater detail because you can read all the actual values from it, but not from the histogram in Table 5.

   c. Not all of the bars touch in Table 6 because it shows the gaps in the data. (Each centimetre measure is kept separate, and there are no astronauts for some heights in the range.) However, you cannot see these gaps in the histogram in Table 5 because the values are grouped into continuous 5-cm intervals.

7. Table 7 was made by putting dots to mark the different heights of the columns of Xs from Table 3 (or the heights of the bars from Table 6). Next, Table 7 was made to look like a broken-line graph by connecting the dots in order from left to right. In this way, the line plot in Table 3, the bar graph in Table 6, and the broken-line graph in Table 7 all look similar in shape.

8 **a.** Someone may try to find the number of astronauts who happen to be a particular height by reading up to the line between the dots at that particular height. For example, someone may think that one astronaut from the sample was 165 cm tall, and this is wrong. (No astronaut from the sample was 165 cm tall.)

   b. This problem can be avoided either by not connecting the dots with lines or, perhaps, by drawing the line down to zero for each centimetre reading where no astronaut in the sample had that height. (However, doing this wouldn't be very practical.)

   One limitation of broken-line graphs is that you cannot always trust information you get by reading between the data points!

9. **a.** All seven tables can be used to tell how many astronauts were sampled. However, it may be easiest to get that information from Table 2. (Add the frequencies.)

   b. A total of 36 astronauts were sampled.

c. You can identify the least height and the greatest height in Table 1, Table 3, Table 4, Table 6, and Table 7.

10. a. By using Table 2, you can quickly tell that astronauts standing in the middle of the line have heights between 175 cm and 179 cm. From question 9.b., there are 36 astronauts in the sample.

$$36 \div 2 = 18$$

Therefore, the astronauts standing 18th and 19th in line are in the middle. They must appear in the interval from 175 cm to 179 cm because the frequency column of Table 2 tells that there are 17 astronauts taller than 179 cm (in the largest two intervals).

b. You can most easily identify the exact height(s) of the astronaut(s) standing in the very middle by using Table 1, Table 3, or Table 4. The two astronauts standing in the very middle both have a height of 178 cm. You can also discover this by using Table 6 and Table 7 (but it takes more work).

11. Answers will vary. Sample answers are given.

a. The question "How many of the astronauts are 180 cm tall?" can be answered by using Table 6 but not Table 2.

b. The question "How many astronauts are taller than 174 cm?" is easier to answer by using Table 2 than by using Table 6.

Activity 2

1. a. There were 27 apples in the bag. Multiply the dimensions of the array.

$$3 \times 9 = 27$$

b. There will be a single value in the middle because there is an odd number of values. The middle value will be in the fourteenth position. (Of the 27 values, there will be 13 before it and 13 after it.) Knowing this mass tells you that half of the apples in the bag are lighter than that particular one, and half of them are heavier than it.

2. A stem-and-leaf plot is useful to sort the data so that it is easy to find the least value, the greatest value, and the middle value. The plot puts the values in order.

3. Use just the hundreds digit to form the stems and use the tens and ones digits together to form the leaves.

MASSES (IN GRAMS) OF APPLES IN A 4-KG BAG

|	
0	88 89 90 92 95 95 98
1	07 10 25 29 35 41 48 50 56 63 74 75 88 92
2	00 09 09 13 19 25

4. a. The lightest apple is 88 g. (It is the first leaf in the stem of the least value.)
 b. The heaviest apple is 225 g. (It is the last leaf in the stem of greatest value.)

5. The apple with a mass of 148 g is heavier than half of the apples and lighter than half of the apples. (It is in the fourteenth position.)

6. A histogram is useful to give an overall picture of how the values are distributed between the least and greatest values.

7. a.   MASSES (IN GRAMS) OF APPLES IN A 4-KG BAG

Mass (to nearest g)	Tally of Apples	Number of Apples (Frequency)
50–99	††₦ //	7
100–149	††₦ //	7
150–199	††₦ //	7
200–250	††₦ /	6

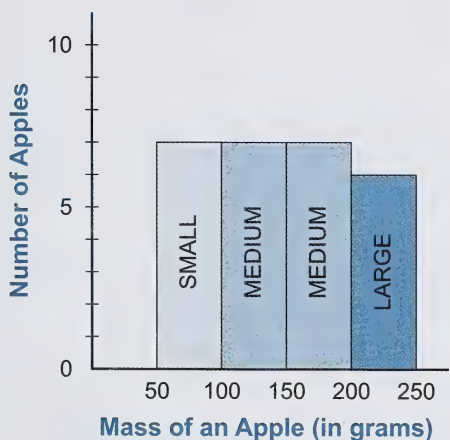**b.** Answers may vary. A sample histogram is shown.

MASSES OF APPLES IN A 4-KG BAG
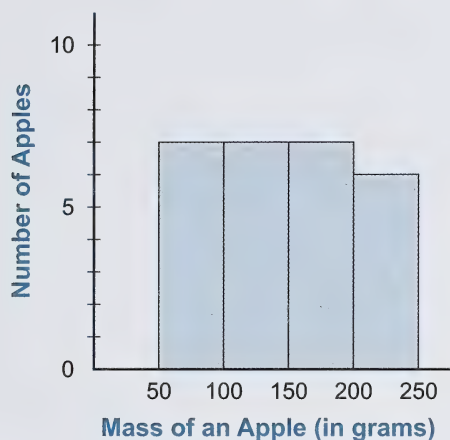
8. Answers may vary. Sample answers are given.

a. The three different categories of sizes are shown in the following graph.

MASSES OF APPLES IN A 4-KG BAG

b. The medium category has the most apples (14 apples).

9. Mitch may choose the middle nine apples to make his pie.

MASSES (IN GRAMS) OF APPLES IN A 4-KG BAG

0	88	89	90	92	95	95	98						
1	07	10	25	29	35	41	48	50	56	63	74	75	88	92
2	00	09	09	13	19	25							

10. a. Instead of asking for nine apples, the recipe may have called for about 1325 g of apples. This seems reasonable because the total mass of the nine middle apples is

$$125 \text{ g} + 129 \text{ g} + 135 \text{ g} + 141 \text{ g} + 148 \text{ g} + 150 \text{ g} + 156 \text{ g} + 163 \text{ g} + 174 \text{ g} = 1321 \text{ g}$$

b. Mitch could choose a different number of apples that total approximately 1325 g. For example, he could use all six large apples and half of the smallest apples.

$$200 \text{ g} + 209 \text{ g} + 209 \text{ g} + 213 \text{ g} + 219 \text{ g} + 225 \text{ g} + (88 \text{ g} \div 2) = 1319 \text{ g}$$

Activity 3

1. a. The population is customers of Clear Lake Winter Fun Centre.

b. Sigurd may have collected the data he used to make the circle graph by any of the following methods:

- having people in the cafeteria complete a questionnaire

- asking people as they were entering or exiting the centre

- counting how many people were doing the different activities at a certain time of day

2. a. One-fourth of the circle (25%) represents skating. You can visualize folding the circle into fourths by folding it in half twice.

b. Downhill skiing is represented by the same fraction as skating. You can see that both sectors are the same size because they both look like they contain right angles.

c. For Sigurd to claim that three-eighths of the circle represents tobogganing without using a protractor, he may have visualized flipping the skating sector onto the tobogganing sector, or he may have extended the segment between skating and cross-country skiing straight across, splitting the tobogganing sector into a right angle and an extra part. That extra amount left is the same size as the cross-country skiing sector, and together they must be one-fourth. One-fourth is equal to two-eighths, so the tobogganing sector is three-eighths of the circle.

3. a. No, the sizes of the sections in the circle graph do not match the numbers of people doing different activities shown in the picture on pages 148 and 149. Most of the people in the picture are skating and only a few are either tobogganing, downhill skiing, or cross-country skiing. Yet, the circle graph shows that tobogganing is the most popular sport.

b. Following are some reasons why this might be so:

- The picture might show only part of the recreation centre.

- Some activities may be more popular on certain days.

- Some activities may be more popular at certain times of the day.

- Some equipment for an activity may not be available for rental (being repaired).

c. To make his graph more meaningful, Sigurd might have given some idea of the size of his sample. (Generally, the bigger the sample the better.) For example, he could have

- stated the length of time over which the data was collected (e.g., the entire season, a particular month, a particular day)

- stated the number of people who chose each of the activities

d. The circle graph might be used by the centre to

- consider expansions of their facilities (e.g., open a special toboggan run)

- to decide what type of equipment to get (e.g., different types of toboggans and sleds)

- plan activities (e.g., family skating party or a hockey tournament)

- hold special promotions (e.g., half-price cross-country ski rentals)

4. a. The line plot shows that the equipment people rent most is downhill skis, and the picture shows only a few people downhill skiing.

b. Reasons why this might be so are as follows:

- Perhaps many people who enjoy downhill skiing do not own their own skis.
- It is likely that most people who enjoy skating own their own skates.

5. a. The data from the line plot and the circle graph seem most different for tobogganing. The line plot shows tobogganing to be the activity with the least amount of equipment rentals, and yet tobogganing is the most popular sport.

b. Reasons why this might be so are as follows:

- Perhaps most people who enjoy tobogganing own their own toboggans.

- Several people can share a single toboggan.

- Maybe the length of time over which the data was collected for the line plot is different than that of the circle graph.
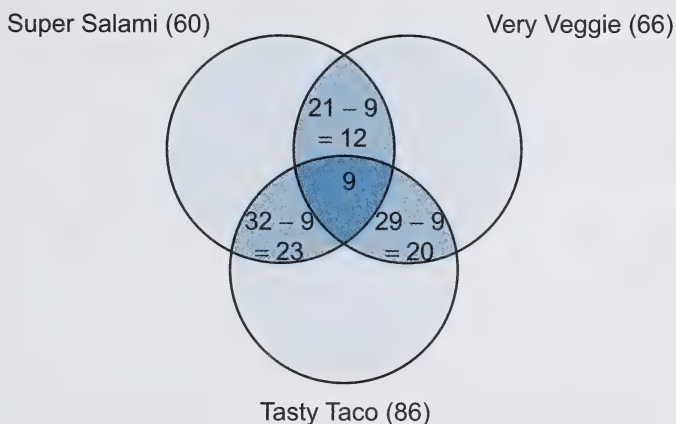
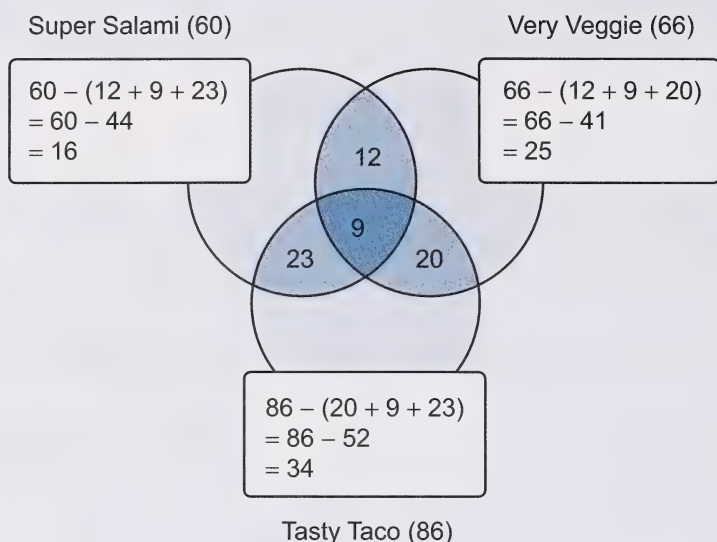**6.** The line plot may be used to decide

- how much of each kind of equipment is needed

- how much to budget for equipment maintenance (e.g., skate-sharpening machine)

- to plan for more storage space, if necessary

7. a. Skating may be more affected by the temperature than other activities because it is unsafe to skate on a pond when the temperature is near 0°C.

b. Other weather conditions are important for the winter sports.

- The amount of snow affects the quality of skiing and tobogganing.
- The temperature can affect the quality of the snow for cross-country skiing.
- Winter storms might require the centre to close.

c. The broken-line graph may be used to decide opening and closing dates for the centre.

8. a. People might also like to rent snowboards, sleds, large inner tubes, goggles, helmets, hockey sticks, and nets. They may like to buy hockey tape, laces, socks, earmuffs, or gloves.

b. Sigurd might collect this data by interviewing people at the centre.

9. Sigurd might recommend that they sponsor ski races, advertise in newspapers and on the radio, sell season's passes, and hire more staff.

Challenge Activity

One hundred thirty-nine people tried the new kinds of pizza. Make a Venn diagram.

Super Salami (60)　　　　　　　　Very Veggie (66)

21 – 9
= 12

9

32 – 9
= 23

29 – 9
= 20

Tasty Taco (86)

Super Salami (60)

$$60 - (12 + 9 + 23)$$
$$= 60 - 44$$
$$= 16$$

Very Veggie (66)

$$66 - (12 + 9 + 20)$$
$$= 66 - 41$$
$$= 25$$

12

9

23   20

$$86 - (20 + 9 + 23)$$
$$= 86 - 52$$
$$= 34$$

Tasty Taco (86)

Add the numbers in all seven areas.

$$16 + 25 + 34 + 12 + 23 + 20 + 9 = 139$$

Keystrokes

1. Answers will vary. Sample answers are given.

Whole Number	Sum of Digits	Is the Sum Divisible by 3?	Is the Whole Number Divisible by 3?
471	$4 + 7 + 1 = 12$	yes: $12 \div 3 = 4$	yes: $471 \div 3 = 157$
23 891	$2 + 3 + 8 + 9 + 1 = 23$	no	no
309 566	$3 + 0 + 9 + 5 + 6 + 6 = 29$	no	no
9798	$9 + 7 + 9 + 8 = 33$	yes: $33 \div 3 = 11$	yes: $9798 \div 3 = 3266$
38 619	$3 + 8 + 6 + 1 + 9 = 27$	yes: $27 \div 3 = 9$	yes: $38\ 619 \div 3 = 12\ 873$
147 820	$1 + 4 + 7 + 8 + 2 + 0 = 22$	no	no
62 902	$6 + 2 + 9 + 0 + 2 = 19$	no	no
874 119	$8 + 7 + 4 + 1 + 1 + 9 = 30$	yes: $30 \div 3 = 10$	yes: $874\ 119 \div 3 = 291\ 373$
993	$9 + 9 + 3 = 21$	yes: $21 \div 3 = 7$	yes: $993 \div 3 = 331$
51 688	$5 + 1 + 6 + 8 + 8 = 28$	no	no

2. If the sum of the digits is divisible by 3, the whole number is divisible by 3.

3. This will be true for all whole numbers.

4. • $10 \div 3 = 3$ R1, $100 \div 3 = 33$ R1, and $1000 \div 3 = 333$ R1

   • For each tens rod, you will have 1 unit left when you remove all possible groups of 3.

   • For each hundreds flat, you will have 1 unit left when you remove all possible groups of 3.

   • For each thousands block, you will have 1 unit left when you remove all possible groups of 3.

   • This means that the digits in each place value tell you how many units are left.

   • Combine the units you have left (by adding the digits). If you can remove groups of 3 and have none left, then the number is divisible by 3.

5. a. A box is drawn around a group of 16 numbers that form a 4-by-4 array.

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

b. $4 \times (1 + 4 + 22 + 25)$
$= 4 \times 52$
$= 208$

c. $1 + 2 + 3 + 4 + 8 + 9 + 10 + 11 + 15 + 16 + 17 + 18 + 22 + 23 + 24 + 25 = 208$

The sum of the 16 dates is equal to 4 times the sum of the corner dates.

6. Answers will vary. Sample answers are given. The calendar for October 2003 is used as an example.

    a. A box is drawn around a group of 16 numbers that form a 4-by-4 array.

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

    b. $4 \times (5 + 8 + 26 + 29)$
$$= 4 \times 68$$
$$= 272$$

    c. $5 + 6 + 7 + 8 + 12 + 13 + 14 + 15 + 19 + 20 + 21 + 22 + 26 + 27 + 28 + 29 = 272$

    The sum of the 16 dates is equal to 4 times the sum of the corner dates.

7. Yes, the pattern will be true for the population of all calendars.
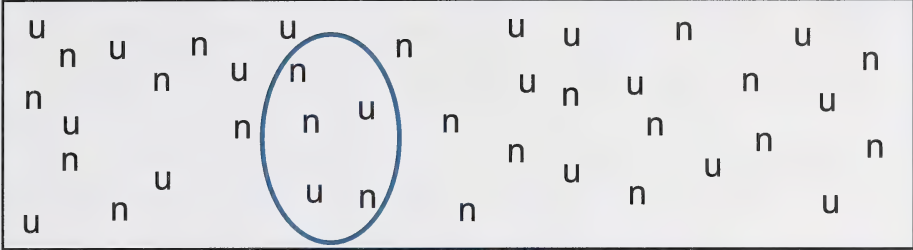
Review

1. a. Your four best friends is not a good sample because friends often like the same sorts of things. Also, maybe all four of your best friends aren't 4-H members.

    b. Four girls is not a good sample because some t-shirt styles may be more appealing to girls than to boys.

    c. Four boys is not a good sample because some t-shirt styles may be more appealing to boys than to girls.

    d. The first four names in an alphabetical member list is a good sample because this does not influence the styles of t-shirts people like.

    e. Four people sitting near you is a good sample because this does not influence the styles of t-shirts people like.

2. You might show a sample of each available t-shirt and then pose the question as follows: "Which style of t-shirt should we order for everyone?"

3. Textbook, page 153, Practise Your Skills, questions 1 to 5

Answers will vary. Sample answers are given.

1.

u n u n u n u n n n u n u n n u n u n u n u u u n n n u u n n u n n n u n u n n n u n u n u u n u u u n n u u u n n u n

2.

Letter	Tallies	Frequency
u	//	2
n	///	3

3. In the total population, the letter u will likely occur 16 times and the letter n will likely occur 24 times. Since $40 \div 5 = 8$, the population is 8 times as large as the sample, so each letter should occur 8 times as often as it did in the sample. ($8 \times 2 = 16$ and $8 \times 3 = 24$)

4.

Letter	Tallies	Frequency
u	┼┼┼┼ ┼┼┼┼ ┼┼┼┼ ///	18
n	┼┼┼┼ ┼┼┼┼ ┼┼┼┼ ┼┼┼┼ //	22

5. The prediction was very accurate. There were only two more of letter u in the population than predicted and just two fewer of letter n than predicted.

4. **Textbook, page 203, Skill Bank Looking Back, question 4**

4. No, this is not a random sample. In a random sample, all members of a population must have an equal chance of being included in the sample, but Hugo only asked people who lived near him. People's opinions about the proposed highway will likely be affected by how close their homes are to where it is to be built. The people in Hugo's sample are not representative of the town because they all live close to each other.

5. **Textbook, page 162, On Your Own, question 1**

1. **a.**

EDUCATION LEVELS OF CANADIANS
15 YEARS AND OLDER FOR 1971 AND 1991
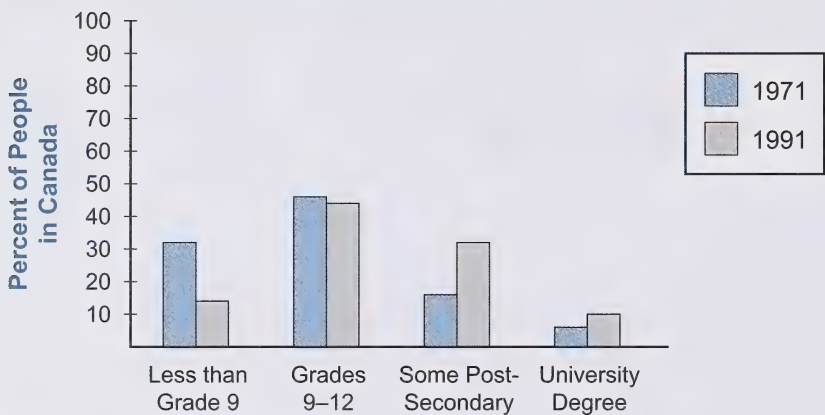
b. Answers will vary. Sample answers are given.

- In 1991, the number of Canadians with some post-secondary and with university degrees was about double what it was in 1971.

- In 1991, the number of Canadians with Grades 9–12 was about the same as it was in 1971.

- In 1991, the number of Canadians with less than Grade 9 was less than half of what it was in 1971.

6. **Textbook, page 174, Skill Bank from This Unit, question 3.a.**

3. **a.** CONTENTS (IN GRAMS) OF 400-G BOXES OF A
           CEREAL COMPANY'S PRODUCTS

39	2 5 7 8 9 9
40	0 0 0 1 1 1 1 1 1 2 2 3 5 5 6 6 7 9
41	1

7. **Textbook, page 163, On Your Own, question 3**

3. **a.**   MATH TEST SCORES FOR A CLASS
                       OF GRADE 6 STUDENTS

Math Test Scores (as a percent correct)
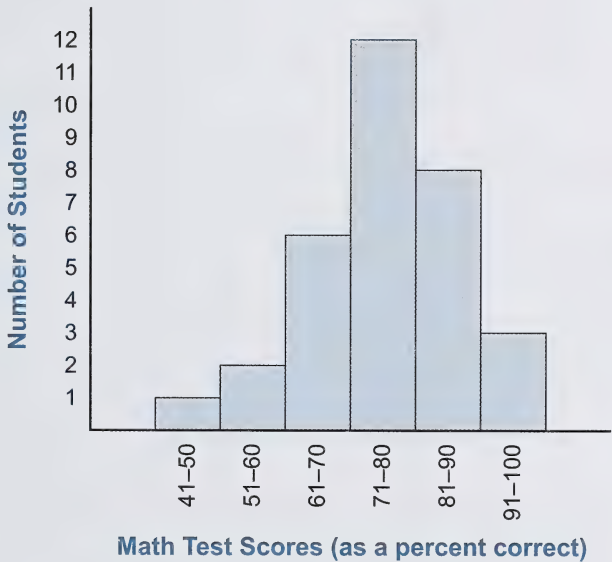
b. Eleven students scored above 80.

c. The median (value in the middle) is in the 71% to 80% interval.

8. Textbook, page 223, Skill Bank Looking Back, question 2

2. NUMBER OF KILOMETRES DAN AND MEREDITH
JOGGED IN FOUR CONSECUTIVE WEEKS
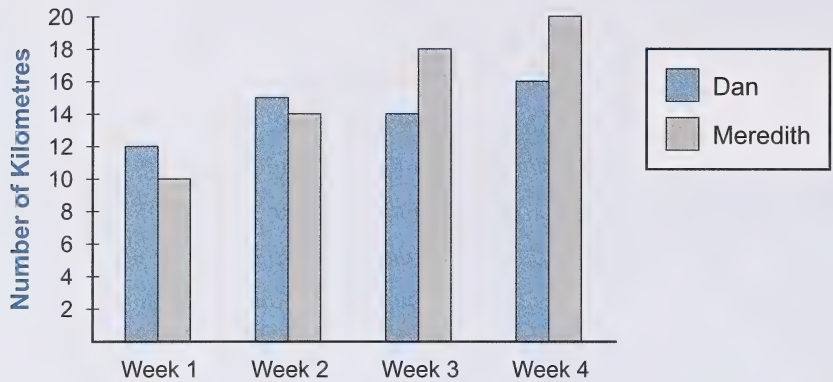
9. Textbook, page 203, Skill Bank Looking Back, question 6

**6.   HEIGHTS (CM) FOR THE
STANDING HIGH JUMP FOR
A GRADE 6 CLASS**

6	8
7	3 5 5 6 7 9
8	0 0 1 1 1 2 4 5 9
9	1 5

The median height is 80.5 cm. There are 18 values, which is an even amount, so there are two numbers in the middle: 80 cm and 81 cm. **Note:** To find the median, find the average of those two middle values (half their sum): 80 cm + 81 cm = 161 cm, 161 cm ÷ 2 = 80.5 cm.

10. Textbook, page 163, Practise Your Skills, question 1

1. a.   **ENGLISH TEST SCORES**

Interval	Tally	Frequency
20–29	//	2
30–39	//	2
40–49	////	4
50–59	⊦⊦⊦ ⊦⊦⊦ /	11
60–69	⊦⊦⊦ //	7
70–79	⊦⊦⊦	5
80–89	//	2
90–99	/	1

b.

ENGLISH TEST SCORES
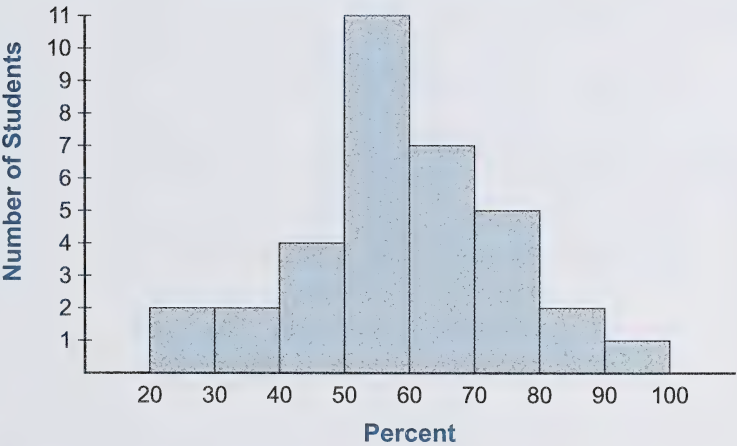
c. Fifteen students passed.

d. Thirty-four students wrote the test.

11. **Textbook, page 160, Practise Your Skills, questions 1 to 3**

   1. The range is 12 (difference between largest and smallest: 12 - 0 = 12).

   2. One hundred fifty movies were rented.

      $1 + (4 \times 2) + (2 \times 3) + (9 \times 4) + (3 \times 5) + (2 \times 6) + (5 \times 8) + (2 \times 10) + 12$
      $= 1 + 8 + 6 + 36 + 15 + 12 + 40 + 20 + 12$
      $= 150$

   3. The data cluster around 4.

12. **Textbook, page 161, Double-Bar Graphs, questions 1 to 4**

   1. One hundred students were surveyed (fifty from Grade 4 and fifty from Grade 6).

   2. The graph compares the number of Grade 4 and Grade 6 students who prefer each leisure activity.

   3. Answers will vary. Sample answers are given.

      • The favourite activity for both grades is watching TV.

      • About the same number of Grade 4 and Grade 6 students prefer watching TV.

      • The activity least chosen (by both grades) as being their favourite is Hobby.

   4. It is called a double-bar graph because it shows the results of a survey for two different groups and allows you to compare the results of the two groups.

13. **Textbook, page 162, On Your Own, question 2**

   2. a. About 75 people are between 0 and 19 years of age.

      b. About 290 people are 40 or older.

c. Answers will vary. Sample answers are given.

- The most common age group in Lowville is 20 to 39 years.

- The population of Lowville is about 575.

- There is about the same number of people under 40 as over 40.

- There aren't many people 100 or older because the histogram combines them with the 80–99 group to make one wide interval.

14. Textbook, pages 146 and 147

a. This graph doesn't state the kind of computer, nor does it list the scale for the prices.

b. The bar graph is missing a scale for the number of sales.

c. Answers will vary. A sample answer is given.

In the line plot, you might like to know what the population of students was, how old the students were, which year the survey was made, and why March was picked.

d. The stem-and-leaf plot is missing the units for the heights. It doesn't tell the ages (or school grades) or gender of the basketball players.

e. Answers will vary. A sample answer is given.

The sample used for the double-bar graph might have come from schools in the community.

15. a. Textbook, page 158, Line Plots, questions 1 to 5

1. Line plot c.
2. Line plot a.
3. Line plot d.
4. Line plot b.
5. Line plot e.

b. Textbook, page 159, Line Plots, question 1

1. **a.** There are 24 students in the class. Each symbol represents one student and there are 24 symbols in each plot.

   b. The data members for "plot a" (shoe size) were most alike. (Its range is $10 - 4 = 6$.) Also, the data members for "plot b" (number of phone calls) were quite alike. (Its range is $10 - 1 = 9$.)

   Data members for "plot e" (time to count to 100) were least alike. (Its range is $180 - 30 = 150$.)

16. Textbook, page 203, Skill Bank Looking Back, question 5

5. **a.** The range is 6 hours ($9 - 3 = 6$).
   b. The data cluster around 5 hours.

17. Textbook, page 223, Skill Bank Looking Back, question 3

3. Answers will vary. Sample answers are given:

   • The most frequent time for daytime accidents in May is between 7:00 A.M. and 9:00 A.M.

   • The number of accidents between 9:00 and 11:00 A.M. is the same as the number of accidents between 1:00 and 3:00 P.M., when daytime accidents are at a minimum.

   • The number of accidents between 11:00 A.M. and 1:00 P.M. is the same as the number of accidents between 3:00 and 5:00 P.M.

18. Textbook, pages 170 to 173, Problem Bank, questions 6 to 10

6. FAVOURITE FLAVOURS OF POTATO CHIPS FOR A GRADE 6 CLASS

```
                    ×
                    ×
                    ×
                    ×
                    ×
                    ×
                    ×
      ×             ×
      ×             ×
      ×             ×
      ×             ×
      ×             ×
      ×             ×              ×           ×
      ×             ×       ×      ×           ×
   Salt and      Ketchup    Regular   Dill    Sour Cream
   Vinegar                           Pickle   and Onion
```

7. a. Wheat exports to Western Europe decreased every year from 1988 to 1992.

b. Answers will vary. A sample answer is given.

Wheat exports to Eastern Europe decreased between 1988 and 1989, increased greatly between 1989 and 1991, and then decreased again between 1991 and 1992. This may have affected the income of wheat farmers in Canada, depending on how exports to Europe affect total exports.

8. a. **MATH TEST MARKS FOR A**
         GRADE 6 CLASS

5	8
6	2 5 6
7	4 4 5 6 6 7 8 8 8
8	0 0 1 2 2 3 3 3 5 6 7
9	0 3 7
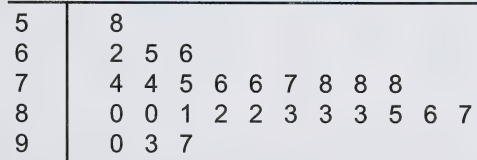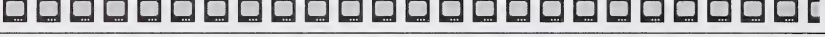
b. The plot shows that most of the students did well on the test. (Most students got between 74–87 marks.)

c. The median mark (value in the middle) is 80 marks.

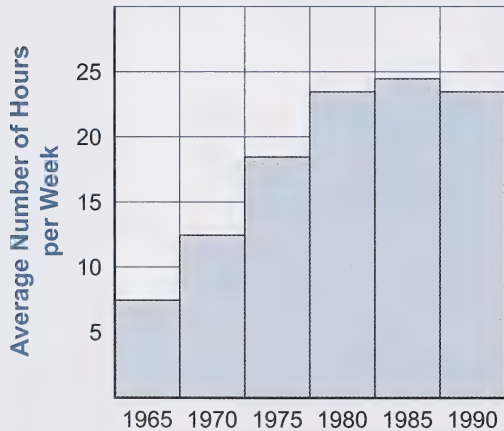**9.** Answers will vary. Sample answers are given.

  a. You could use a pictograph, a bar graph, or a broken-line graph.
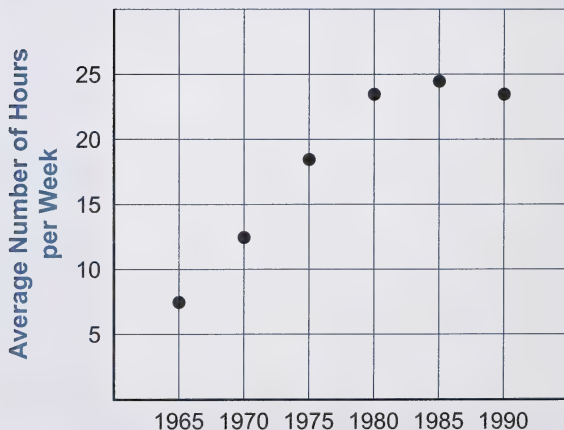
  b. Three different graphs are shown.

TELEVISION VIEWING PER PERSON

Year	Average Number of Hours per Week Scale: ☐ = 1 hour
1965	☐☐☐☐☐☐☐[
1970	☐☐☐☐☐☐☐☐☐☐☐☐[
1975	☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐[
1980	☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐[
1985	☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐[
1990	☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐[

TELEVISION VIEWING PER PERSON

TELEVISION VIEWING PER PERSON

c. The line graph seems easiest to draw. There is less drawing and colouring.

d. The bar graph seems easiest to read. The tops of the bars are wide and flat.

e. Television watching seems to be levelling out between 20–25 hours per week.

10. Answers will vary. Sample answers are given.

a. The population in Saskatchewan dropped between 1971 and 1976, increased between 1976 and 1986, and then dropped again slightly.

b. It would be useful to know why the population dropped between 1971 and 1976, and between 1986 and 1991. This would help to make predictions about Saskatchewan's population beyond 1991.

Just the Facts

Multiplication and Division Facts

3	3	12	8	63
0	42	9	10	9
0	2	18	1	6
5	64	7	15	6
35	6	0	4	32

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